

S-ES-B

# On some taxonomic problems of Asiatic wild asses; with the description of a new subspecies (*Perissodactyla*; Equidae)

By COLIN P. GROVES and VRATISLAV MAZÁK

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Since writing their earlier papers on Asiatic wild asses (GROVES, 1963; MAZÁK, 1963) the present authors have been able, between them, to study a far greater amount of material than before; perhaps much more than any other students of these animals. This larger amount of material (from all the large collections of Europe and America) enables the authors to make a more accurate assessment of the status and inter-relationships of the forms of Asiatic wild asses than has hitherto been possible.

In recent years attention has been redirected to this group of Equids by the work of TRUMLER (1959, 1961), who has insisted on the necessity for a rethinking of the points of view advanced years ago by such workers as LYDEKKER (1905), SCHWARZ (1929) and ANTONIUS (1932) and still currently accepted (e. g. ELLERMAN & MORRISON-SCOTT, 1951; HALTENORTH & TRENSE, 1956; HEPTNER, NASOMOVITCH & BANNIKOV, 1961). It must be stated, however, that TRUMLER's work, valuable and challenging though it is, is unlikely to find ready acceptance among the majority of mammalogists because of the fineness and multiplicity of the taxa recognised. There is therefore a need for a comprehensive revision based on modern population systematics, which is likely to respect both morphological and biological concepts of species and subspecies.

## 1. Generic division of recent Equids

The question of the number of genera of recent *Equidae* is in dispute. Most authors still recognise but a single genus *Equus*; HARPER (1945) separates the asses — Asiatic and African — as genus *Asinus* Gray, 1824; while both TRUMLER (1961) and QUINN (1957) recognise no fewer than four genera, the Asiatic wild asses and their fossil relatives being placed in a separate genus, for which QUINN uses the invalid name *Onager* Brisson, 1762, and TRUMLER the more correct name *Hemionus* Stehlin & Grazioli, 1935.

In the present paper it is proposed to recognise a threefold generic division, in which the true horses would stand alone in the genus *Equus* Linnaeus, 1758 (i. e. *Equus s. str.*), the zebras would fall naturally into a second genus *Hippotigris* H. Smith, 1841, and the African as well as Asiatic asses would belong together in the genus *Asinus* Gray, 1824.

The reasons for placing the Asiatic wild asses in the genus *Asinus* are as follows:

The skulls of both African and Asiatic wild asses are very similar and contrast with both *Equus* and *Hippotigris*. FLEROV (1931) gives a "key" to the skull-characters of the Equidae; not all his findings are entirely reliable, but certain distinctions between *Equus* and *Asinus* (FLEROV includes Asiatic wild asses in the latter genus) may be noted, viz. that in the latter the Meatus acusticus projects beyond the Squama temporalis, and is therefore easily visible from above, whereas in *Equus* it is little if at all visible, being much shorter. In addition to the characters mentioned by FLEROV another difference may be observed: in *Equus* the occiput tends to be rounded in shape

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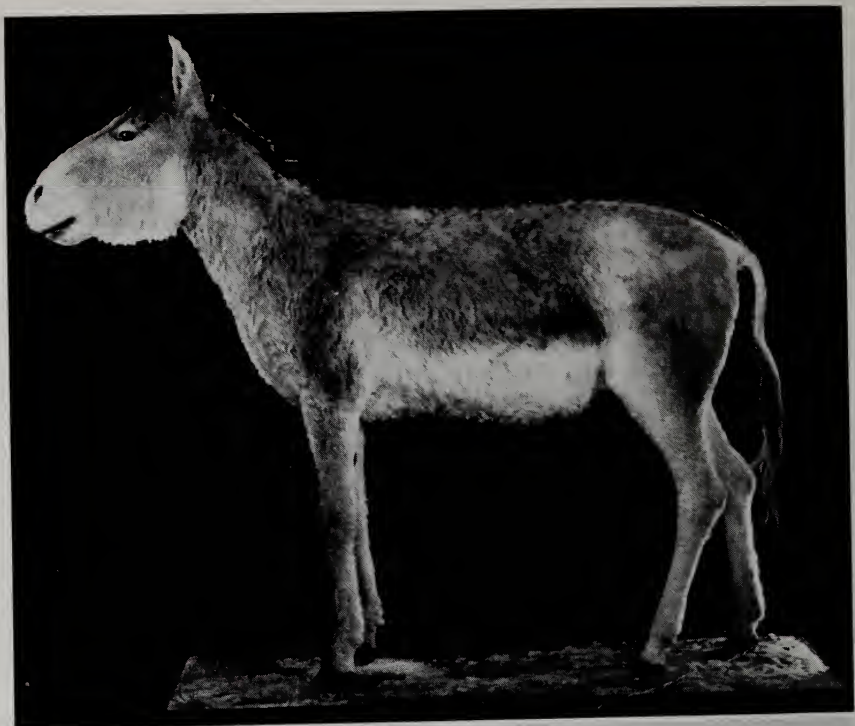


Fig. 1. Above: Holotype of *Asinus hemionus kulan* subsp. nov.; National Museum Prague No. 10698. Winter coat (Photo: Dr. IVAN HERÁN, National Museum Prague), Below: Two males of *Asinus hemionus kulan* subsp. nov. fighting. A clear shoulder stripe may be seen on the specimen on the left (Photo: V. RASHEK, Barsa Kelmes Island)



Fig. 2. Above: *Asinus hemionus kulan* subsp. nov. in summer coat. Zoological Garden Prague. All three specimens came from Badkhyz Reserve, Turkmenia (Photo: the authors), Below: *Asinus hemionus khur* from Cutch, in Ahmedabad Zoo. By permission of the Zoological Society, London

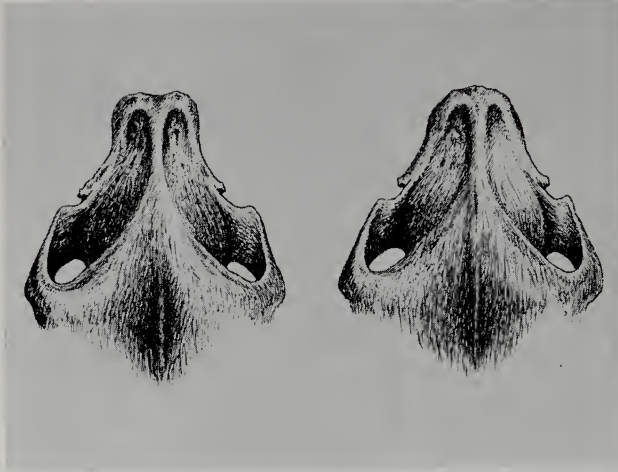


Fig. 3. Form of occiput in the genus *Asinus* (left) and *Equus* (right)

without the square, parallel-sided shape seen in *Asinus* and *Hippotigris* (fig. 3); further the horse skull may be distinguished by its general elongated form, long molar row and broad incisor region. By contrast the only reliable feature of the skull differentiating the African from the Asiatic wild asses is the more elongated cranial portion of the skull in the former.

By the skull shape, the genus *Hippotigris* (including all zebras and quaggas) may likewise be distinguished from both *Equus* and *Asinus*.

In particular the high, convex neurocranium is noticeable; the orbits are low-placed when viewed in norma lateralis; the lateral parts of the frontal bones slope strongly to the orbital margins; and the greatest skull breadth is in the region of the Crista facialis instead of at the hind orbital margins.

The tooth differences said to exist between the asses (Asiatic and African) and horses are summarised by CLUTTON BROCK (1962). The differences are, however, in many cases inconstant; certainly the impression generally given in the palaeontological literature, that teeth are consistently diagnostic in their pattern and can be used to identify species and genera without exceptions, needs to be revised. On the basis of the material in the British Museum and of more casual observations on other specimens, the authors have gained the impression that the following tooth characters more constantly distinguish among different forms of *Equus* and *Asinus*:

#### A. Upper teeth

1. The edges of the pre- and postfossettes are much more folded and intricate in the horses, less so in the asses; among the latter group, the folding is rather more pronounced in *A. hemionus* than in *A. africanus* or *A. kiang*.
2. The interstylar faces are more angular in the horse, and more evenly curved with slight convexities in the asses.
3. The styles are thinner in asses than in the horse.
4. Horse teeth tend to be more square, especially the molars.
5. In *Asinus kiang* and *A. hemionus* the protocone is generally elongated, especially in a backward direction. But it is sometimes as short as in the horse, which may also have an elongated protocone; *Asinus africanus* usually has a very short protocone, but the adult male *A. a. africanus* skull in the British Museum has a long one. In view of the fact that this feature is the one most commonly used to identify „Hemione“ remains in fossil and prehistoric sites, the amount of variability is worth noting.
6. On P<sup>3</sup> and P<sup>4</sup>, the Kiang has a fold at the root of the protocone; this fold is sometimes only slightly indicated — a condition often seen in other forms.

## B. Lower teeth

1. In the horse, the metaconid-metastylid valley penetrates more deeply than it does in the asses; the same is true for the protoconid-hypoconid valley. In the kiang the metaconid-metastylid valley is slightly more penetrating than in *A. hemionus* or *A. africanus*, and so assumes a V shape reminiscent of the type seen in the horse, rather than the U shape of other asses. The *A. hemionus hemionus* skull in the British Museum, from Ebi Nor, has a kiang-like arrangement.
2. The hypoconulid is larger and more marked in the horse and kiang, but often hardly visible in *A. hemionus* and *A. africanus*.

The other characters mentioned by CLUTTON BROCK appear to have no very great validity as far as can be judged from the variability they show in even a relatively limited sample such as that in the British Museum. It will be noticed from the above list that the three groups given generic level by QUINN and TRUMLER do not seem to be alone in having distinguishing dental characters: thus, among the three species of *Asinus* here recognised — *A. kiang*, *A. hemionus*, *A. africanus* — the dental differences seem to be about equivalent, while the horse is better distinguished. It would probably always be possible to identify a horse tooth on the combination of characters; but to distinguish the three species of *Asinus* on a single tooth would be distinctly more difficult.

Two other dental features may here be conveniently introduced. One of these, the metaconid-metastylid „bridge“ on the cheekteeth of *Asinus africanus somaliensis* (the Somali wild ass), has already been described and figured by one of us (GROVES, 1966). Most remarkably, such a „bridge“ may be seen on the teeth of the only other Equid found in northern Somalia, namely *Hippotigris grevyi berberensis* (the Somali Grevy's zebra), as represented by three specimens in the British Museum from Ogardain, former British Somaliland. In these the „bridge“ is less marked than in the Somali wild ass, but present nonetheless, on M<sup>1</sup> and M<sup>2</sup>. Such a „bridge“ is not present in Grevy's zebra from Jubaland (southern Somalia) or Kenya. This suggests very strongly that the environment of northern Somalia may place this feature at a selective advantage — precisely what advantage will appear when the mechanics of tooth wear in the *Equidae* are more fully studied.

The second dental feature of interest is the retention of the rudimentary P<sup>1</sup>, the so-called Wolf Tooth. This was thought to be characteristic of the Kiang by HODGSON (1847), but is now known to occur with varying frequencies in most other adult Equids. The adult skulls of Equidae in the British Museum show the following frequencies of retention in the adult stage (i. e. with all permanent teeth in place):

<i>Equus spp.</i>	Domestic, Przewalski . . . . .	0 in 15
<i>Asinus kiang</i>	Tibet, Ladakh . . . . .	8 in 11
<i>Asinus hemionus</i>	Ebi Nor; Kutch; Syria . . . . .	1 in 9
<i>Asinus africanus</i>	Nubia . . . . .	1 in 2
	Sokotra (feral?) . . . . .	2 in 2
	Buraimi (feral?); domestic . . . . .	0 in 6
<i>Hippotigris zebra</i>	Cape Province; Southwest Africa . . . . .	5 in 9
<i>Hippotigris burchelli</i>	South of Zambesi . . . . .	9 in 21
	Zambia; Tanzania; southern Kenya . . . . .	13 in 23
	Northern Kenya; Jubaland; Sudan . . . . .	9 in 11
<i>Hippotigris quagga</i>	Cape Province . . . . .	0 in 1
<i>Hippotigris grevyi</i>	Somalia . . . . .	1 in 4

The form of the Wolf tooth also varies. In *H. zebra* it is a very small tooth, peg-like, fitting into a notch in the antero-lingual corner of P<sup>2</sup>. In *A. kiang* and *A. hemionus* it is also peg-like and fits into a notch, but the tooth is larger. In young horses, as well as in *A. africanus* and the remaining zebras, there is no notch as the Wolf Tooth is more elongate and flatter, and can nestle against the flattened surface of P<sup>2</sup>.

The conclusion of the study of dental characters in the Equidae is that one is as liable to find subspecies showing constant dental differences as one is to find species or genera (the dental distinctions of the Somali wild ass and Grevy's zebra); and, within the non-striped Equids, the horse differs from the three species of asses more than these three differ among themselves. Tooth characters are more variable than has usually been thought; ORLOV (1961) found strong differences even within a single population, the onagers of Badkhyz Reserve.

*Externally* the similarities between the African and Asiatic wild asses, and their differences from horses, are quite clear. In the horse, the chestnuts occur on both fore and hind limbs, while in all asses they are restricted to the forelimbs (the same is the case with zebras). In asses, both African and Asiatic, the hairs forming the mane are shorter and softer than in horses, never being stiff as in the latter. In all asses the tail is more or less tufted, while in the horse (i. e. in the living wild horse *Equus przewalskii* Poliakov, 1881) the form is quite different: it is true that the proximal part of the tail lacks, on its dorsal side, the long „horsehair“ and the character of the hair of this part of the tail is similar to the hair of the body; but the lateral sides of the proximal part of the tail are covered with somewhat stiffer and longer hairs and the true long „horsehairs“ are present on the distal part of the tail only. Nothing similar to this can be observed in asses, with the exception of the Kiang which, especially in winter coat, shows a hair distribution on the tail which somewhat resembles that of the wild horse; never, however, are the hairs on the lateral parts of the tail anywhere near as long and stiff as in a wild or domestic horse.

The colour pattern of the Asiatic asses shows similarities to that of the African asses, and corresponding differences from that of the horse. In all forms the underside, lips and circumocular region are light-coloured to white (this character being least expressed in the wild horse), but in asses this light colouration extends to the legs, which in the horse it does not; instead in the Przewalski horse the shanks are darkened. Likewise the underside of the neck and the hind aspect of the thighs and buttocks are lightened in the asses, which they are not in the horse. Many of the Asiatic wild asses have developed this type of colour-pattern into a marked disruptive colouration, but in the African asses and some Asiatic forms (most markedly in the subspecies from the Gobi desert and from Syria) there is more of an intergradation between the light and dark areas, especially in summer coat. In all forms of asses and wild horses there is a more or less developed dorsal stripe, and at least a tendency to develop a shoulder stripe. Transverse leg-stripes are always present in the Przewalski wild horse and commonly (according to subspecies) in African wild asses, while in Asiatic wild asses they have also been recorded occasionally (GOODWIN, 1940; MOHR, 1961, p. 165). Thus the same markings may be present, though differently expressed, in both horses and asses; but the distribution of dark and light areas on the body is essentially different, and clearly separates them.

Consequently there is good evidence to suppose that the Asiatic wild asses are closer to the African wild asses than to the horses. A classification such as that of TRÜMLER (1961) or QUINN (1957) does not do justice to this fact. It may be, however, that some students of the problem will prefer to include both the Asiatic and African wild asses in the genus *Equus* and keep only subgeneric status for them, instead of the full genus proposed here. The reason for, somewhat tentatively, supporting generic

status in this paper are to allow for the possible recognition of subgenera. These are most likely to arise in the case of fossil material, although some may yet prefer to allot a separate subgenus to the Asiatic wild asses within the genus *Asinus*. Meanwhile it must be emphasised again that the two groups of asses are closer one to another than either is to the horses in the strict sense. The characteristics said to distinguish *Asinus* from *Hemionus* are too variable to be valid, except for the slenderness of the metapodials in *Hemionus* (Table 3) and the comparative elongation of the postorbital part of the skull in *Asinus*. As far as the teeth are concerned, the average differences which exist tend to separate the three species *A. kiang*, *A. hemionus* and *A. africanus* about equally.

## 2. Material

Measurements and observations were made on 154 skulls of Asiatic wild asses which were suitable for taxonomic evaluation in being adult or nearly so (the latter category including just a few specimens); all but 23 of these were of securely known locality. Numerous young specimens were seen but have not been included in this total. The number of skins studied was 67 including mounted specimens; between sixty and seventy living animals of known origin were seen by one or other of the present authors. Finally it must be mentioned that certain photos and illustrations have been very useful in increasing the amount of information on some otherwise poorly documented forms.

The skulls and skins were seen in the Natural History or Zoological Museums of the following cities or Universities: Basel, Berlin, Cambridge (England), Chicago, Frankfurt/M., Harvard, Leiden, Leningrad, London (British Museum of Natural History and Royal College of Surgeons), Moscow, Munich, New York, Paris, Philadelphia, Prague, Stockholm, Tring, Washington (D. C.) and Yale. The living specimens were observed in the following zoos: Antwerp, Berlin (both West and East), Catskill, Hamburg, Leningrad, London, Munich, Paris (Jardin des Plantes), Prague, Rome, Rotterdam and Whipnade.

## 3. The concept of species in the genus *Asinus*

It has previously been urged by one of the authors of this paper (MAZÁK, 1963) that one of the Asiatic wild asses, currently known as *Equus hemionus kiang* Moorcroft, 1841, should on grounds of morphology and biology be recognised as a *bona species*. The morphological grounds for this distinction include colour pattern, form of chestnuts, and form of hair covering of mane and tail. ANTONIUS (1922, p. 251; 1932, p. 266) emphasises also a different form of the rump. There are also differences in reproductive biology and pattern of spring moult (cf. MAZÁK, 1962 and 1963).<sup>1</sup>

In addition to the above-mentioned differences, study of skull material has shown that in the kiang the lower jaw is generally more massive than in *A. hemionus*, with a convex lower border and the upper incisors are more vertically implanted (fig. 4). The teeth show average differences (see above).

<sup>1</sup> As already stated, the tail of a kiang, especially in winter coat, is covered on its lateral surfaces with somewhat longer hairs from the very base of the tail, resembling thus to a certain degree the tail of Przewalski's wild horse. This character is typical for kiangs alone among the asses, and it is necessary to add to a previous paper (MAZÁK, 1963) that this form of tail does occur regularly in adult animals, whereas this is not the case with adults of other wild asses. The authors wish to emphasise this fact again in view of the fact that foals (approximately up to 2 years of age) of other Asiatic wild asses may show a more or less similar type of hair-covering on the tail from time to time.

Table 1  
 Mean values of skull measurements in *Asinus bemiomus* (Pallas, 1775)  
 (adult wild shot specimens)

	<i>Asinus bemiomus bemiomus</i>	<i>Asinus bemiomus luteus</i>	<i>Asinus bemiomus kulani</i>	<i>Asinus bemiomus onager</i>	<i>Asinus bemiomus kbur</i>	<i>Asinus bemiomus bemippus</i>				
	n	n	n	n	n	n				
<i>Males</i>										
Greatest length	—	518.2 ± 10.8	4	496.0 ± 9.3	4	489.0 ± 7.1	3	505.3 ± 13.1	1	419
Basal length	—	458.0 ± 10.7	5	430.6 ± 9.2	4	429.0 ± 10.1	3	445.3 ± 6.0	1	362
Palatal length	—	238.5 ± 7.2	5	214.6 ± 7.3	4	227.3 ± 5.3	3	228.7 ± 3.1	1	189
Diastema length	—	79.8 ± 4.3	5	77.0 ± 4.7	4	69.5 ± 5.6	3	86.3 ± 5.1	1	53
Length of tooth row	—	166.2 ± 4.2	5	154.8 ± 4.8	4	165.8 ± 6.2	3	149.3 ± 8.3	1	140
Diastema breadth	—	45.9 ± 2.8	5	49.8 ± 2.2	4	43.8 ± 1.7	3	49.0 ± 1.7	1	34
Incisor breadth	—	66.3 ± 1.9	5	62.8 ± 2.2	4	64.0 ± 4.2	3	63.3 ± 0.6	1	53
Palatal breadth	—	58.2 ± 4.5	5	61.2 ± 3.8	4	53.3 ± 1.9	3	49.3 ± 5.1	1	43
Orbital breadth	—	201.5 ± 6.9	5	203.6 ± 5.1	4	192.0 ± 12.7	3	198.3 ± 2.9	1	164
Occipital breadth	—	53.8 ± 1.9	4	50.8 ± 2.9	4	62.0 ± 3.5	3	60.0 ± 2.6	1	49
Opisthion toinion	—	58.7 ± 3.3	4	65.0 ± 0.8	4	58.5 ± 2.6	3	58.7 ± 5.7	1	48
Nasal length	—	215.9 ± 6.3	2	198.5	4	194.3 ± 5.9	3	189.3 ± 5.1	1	174
<i>Females</i>										
Greatest length	2	509.5	10	493.3 ± 9.2	2	483.5	2	489.5	3	424.0 ± 13.1
Basal length	2	451.5	10	449.8 ± 9.3	10	429.8 ± 5.8	2	441.5	2	371.0
Palatal length	3	236.3 ± 7.7	10	233.3 ± 8.8	10	215.7 ± 5.5	2	224.0	2	190.0
Diastema length	3	77.1 ± 8.5	10	83.1 ± 7.7	10	79.2 ± 6.1	2	61.5	3	57.0 ± 5.0
Length of tooth row	3	168.8 ± 3.8	10	165.1 ± 4.7	10	162.0 ± 8.2	2	166.0	2	148.0 ± 1.0
Diastema breadth	3	45.3 ± 3.3	10	40.9 ± 1.7	10	42.4 ± 2.5	2	39.5	2	38.3 ± 2.1
Incisor breadth	3	65.5 ± 0.9	10	62.5 ± 2.7	10	57.2 ± 3.0	2	60.5	2	53.0 ± 1.0
Palatal breadth	3	61.6 ± 4.2	10	56.9 ± 4.7	10	59.6 ± 4.0	2	45.5	2	49.0
Orbital breadth	3	199.7 ± 4.7	10	203.2 ± 9.8	10	196.2 ± 4.2	2	187.0	3	170.0 ± 5.6
Occipital breadth	2	58.3	10	53.9 ± 5.1	9	49.0 ± 3.1	2	57.0	2	46.7 ± 2.5
Opisthion toinion	2	62.0	10	59.8 ± 6.3	10	62.3 ± 2.3	2	57.2	2	48.7 ± 3.2
Nasal length	2	216.5	10	214.7 ± 11.0	6	197.5 ± 4.9	2	181.5	2	192.0 ± 4.6



Table 2

Mean values of skull measurements in *Asinus kiang* (Moorcroft, 1841)  
(adult wild shot specimens)

	n	<i>Asinus kiang holdereri</i>	n	<i>Asinus kiang kiang</i>	n	<i>Asinus kiang polyodon</i>
<i>Males</i>						
Greatest length	7	527.7 ± 12.6	10	518.4 ± 12.0	2	473.0
Basal length	7	463.1 ± 9.4	10	461.2 ± 12.9	2	426.0
Palatal length	7	238.4 ± 6.6	10	235.0 ± 10.7	2	226.5
Diastema length	7	87.0 ± 6.7	10	81.5 ± 6.3	2	75.0
Length of tooth row	5	168.2 ± 3.3	5	159.8 ± 4.0	3	156.0 ± 2.6
Diastema breadth	7	47.3 ± 3.5	10	45.9 ± 2.0	2	40.0
Incisor breadth	7	69.1 ± 4.0	10	69.8 ± 3.0	2	66.0
Palatal breadth	7	60.6 ± 4.3	10	55.4 ± 6.5	3	45.7 ± 2.1
Orbital breadth	7	207.4 ± 6.8	10	211.8 ± 8.3	3	201.3 ± 5.1
Occipital breadth	7	58.9 ± 2.9	10	55.2 ± 4.0	2	53.5
Opisthion toinion	7	61.3 ± 2.5	10	60.3 ± 2.9	2	55.0
Nasal length	6	220.2 ± 6.1	9	203.2 ± 6.8	3	195.0 ± 3.5
<i>Females</i>						
Greatest length	7	519.3 ± 14.7	5	514.2 ± 9.0	3	481.0 ± 11.3
Basal length	7	458.1 ± 11.5	5	456.4 ± 7.5	2	436.5
Palatal length	7	240.7 ± 8.3	5	238.3 ± 3.2	3	226.0 ± 4.7
Diastema length	7	86.0 ± 6.5	5	88.6 ± 6.5	3	79.0 ± 2.2
Length of tooth row	7	165.0 ± 4.3	2	154.0	4	156.0 ± 3.7
Diastema breadth	7	46.2 ± 3.4	5	44.0 ± 2.2	3	45.0 ± 3.9
Incisor breadth	7	68.7 ± 1.4	5	64.0 ± 3.6	3	66.3 ± 3.3
Palatal breadth	7	59.7 ± 3.6	5	54.8 ± 3.1	4	47.0 ± 3.6
Orbital breadth	7	210.6 ± 6.7	5	205.6 ± 6.4	4	207.3 ± 3.2
Occipital breadth	7	57.1 ± 3.9	5	57.7 ± 2.2	3	52.7 ± 3.8
Opisthion toinion	7	63.4 ± 2.4	5	62.3 ± 4.1	2	59.5
Nasal length	3	223.0 ± 11.0	3	203.6 ± 4.0	3	198.3 ± 5.3

Some differences in skull proportions between kiangs and other Asiatic wild asses can be found in mean values (Tables 1, 2) indeed, but when these are plotted on graphs considerable overlap is found (figs. 5–7). This, however, is no indication of conspecificity, though some authors do suppose so (e. g. ORLOV, in press; HEPTNER, pers. comm. to V. M.).

Equids represent a group of *Perissodactyla* which is very homogeneous morphologically but on the other hand very well differentiated in biology and ecology of different forms and most probably in physiology as well. The closest similarity in skull structure of Equids is seen in the example of African and Asiatic wild asses: when the skull-measurements of *Asinus africanus* are compared with those of Asiatic wild asses no essential differences may be found (see figs. 5–7), though there is absolutely no doubt the African and Asiatic wild asses represent at least two quite different species. Hence, the very close skull structure in *A. hemionus* and *A. kiang* cannot be cited as evidence against holding them for separate species.



Fig. 4. Position of incisors in *Asinus hemionus* (left) and in *Asinus kiang* (right)

The above-mentioned finding on the similarity in skull structure between the two main groups of Asiatic wild asses comes as no surprise. Having consideration for the great morphological homogeneity of all *Equidae* (the differences between the three major groups being so comparatively slight, as mentioned under section [1]) we could only expect this result. So the differences which are so very evident in external appearance, reproductive biology, ecology and obviously in physiology as well, between kiangs and other Asiatic wild asses assume an even greater importance.

Since it is clear that some external differences, as well as less important skull differences, do occur within the framework of the *hemionus* group as well as the *kiang* group, and knowing that these differences are limited geographically, the authors of the present paper hold these two groups of Asiatic wild asses for two distinct species, viz. *Asinus hemionus* (Pallas, 1775), and *Asinus kiang* (Moorcroft, 1841). The fact that the two major groups are more or less separated geographically, i. e. that they are allopatric, cannot be used as evidence one way or the other (cf. general conclusions on the species concept in MAYR, 1963, pp. 496–515; SIMPSON, 1961, pp. 150–1 and 160).

As for the geographical races, or subspecies, of *kiang* and *hemionus*, it can be stated that there are numerous differences on average in skull measurements (see Tables 1, 2) but when the individual figures are plotted on graphs a rather great overlap is found for most of the comparisons (see figs. 5–9). There is, however, one very conspicuous exception, namely the Syrian race of *A. hemionus* (*A. h. hemippus*), which is characterised by a markedly smaller size. Among kiangs the race *polyodon* shows also rather small skull measurements, but when compared with other forms of the species *kiang* the differences are not so important as is the case with *hemippus* and the other forms of *hemionus*.

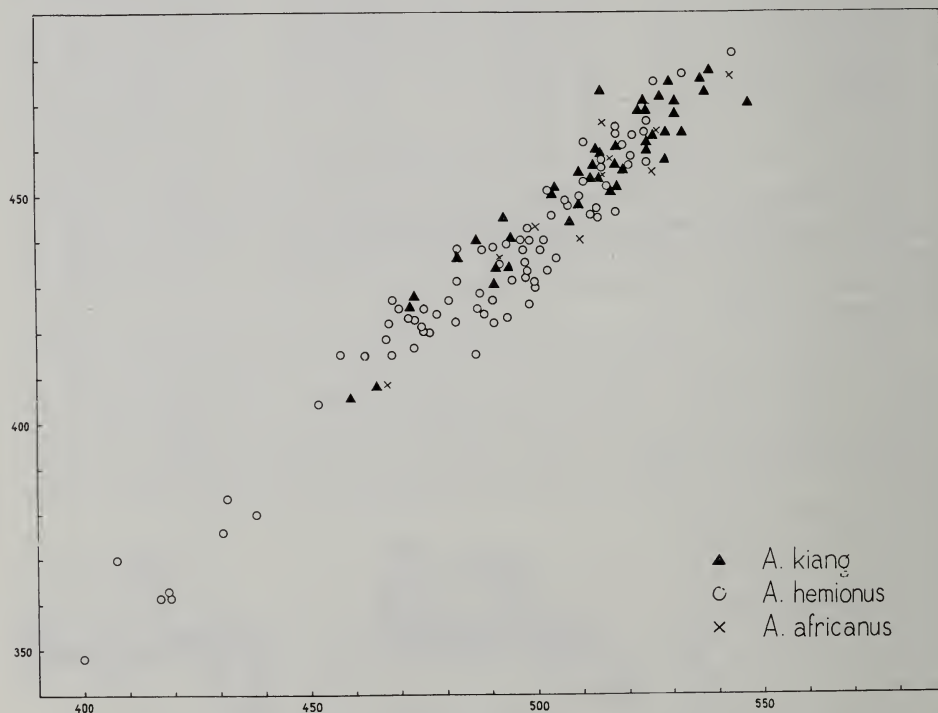


Fig. 5. Skull measurements of African and Asiatic Wild Asses. Ordinate — basal length; Abscissa — greatest length

Table 3

Mean values of different measurement ratios (in %) of postcranial material of *Asinus hemionus*, *Asinus kiang*, and *Asinus africanus*

	metacarpal breadth		metacarpal length		humerus length	
	metacarpal length		radius length		cranium length	
	n		n		n	
<i>Asinus kiang</i>	3	19.46 (18.9 — 20.0)	2	77.00 (75.2 — 78.8)	3	51.73 (50.0 — 52.8)
<i>A. hemionus kulan</i>		—	1	76.7	1	50.9
<i>A. hemionus onager</i>	3	18.60 (17.1 — 19.6)	3	74.40 (72.9 — 75.9)	4	48.87 (46.8 — 50.2)
<i>A. hemionus kbur</i>	2	21.60 (21.0 — 22.2)	2	71.50 (68.4 — 75.1)	2	49.95 (48.6 — 51.3)
<i>A. hemionus hemippus</i>	3	19.06 (18.3 — 19.7)	3	76.43 (75.7 — 77.1)	4	52.42 (51.6 — 53.0)
<i>A. africanus africanus</i>	2	24.05 (23.8 — 24.3)	5	66.56 (65.4 — 70.0)	5	49.26 (46.6 — 51.8)
<i>A. africanus somaliensis</i>	1	21.5	1	67.2	1	47.4

The authors had at their disposal a few measurements of postcranial skeleton (see Table 3). These data, though not too numerous, indicate that there are no important differences among individual races of both species<sup>2</sup>, nor are there any considerable differences between the species themselves.

#### 4. *Asinus hemionus*: the Onagers

When discussing wild asses of the species *hemionus*, it is convenient to recognise three size-groups, which form a *de facto* size cline in the Southwest — Northeast direction.

The smallest form of the species is the most Southwesterly form, the subspecies *hemippus*, or Syrian wild ass, which reaches a shoulder height of 1,000 mm. (39.37 ins.) as observed by ANTONIUS (1928, p. 21) on a living male. The same author gives a shoulder height of 970 mm. for a mounted skeleton of a female (the actual height of the specimen when alive would have been somewhat greater, about 1,000 to 1,020 mm.).

The medium-sized group of *Asinus hemionus* represents the type most commonly exhibited in captivity under the name „Onagers“ (see below): the Indo-Iranian and Transcaspian forms. All of these wild asses reach approximately the same size, being rather close to one another in other characters also. In an earlier paper (MAZÁK, 1963, Table 1) the shoulder heights of five living adult specimens of the Transcaspian wild ass or Kulan from the Prague zoo were given as follows: males 1,080 mm. (old adult) and 1,100 mm.; females 1,175 mm., 1,160 mm. and 1,150 mm. Another male of the

<sup>2</sup> On the contrary there is a certain difference between the African and Asiatic wild asses in the ratio Metacarpal Breadth to Length, indicating that the Asiatic forms have longer, more slender metapodials. This was, however, already shown by ANTONIUS (1922) and QUINN (1957). It is not a clear-cut difference; rather, there is a certain gradation from *kiang* through *kbur* and *somaliensis* to *africanus*.

Transcaspian wild ass which came to Prague from the Badkhyz Reserve stands 1,110 mm. at the shoulder (43.75 ins.). One of the authors (C. P. G.) was kindly informed by Herr TRÜMLER that the female Transcaspian wild ass „Kitty“, which died in Munich zoo in 1963, stood 1,270 mm. at the shoulder, and that the male „Kalif“, still living, was of approximately the same height.

As for the Persian (Iranian) wild ass, SCHWARZ (1929, p. 87) gives for a living female a shoulder height of 1,200 mm. (47 $\frac{1}{4}$  ins.). HARPER (1945) quotes HABLIZL's data, on which the name *Equus onager* Boddaert, 1785, was based, for a male and female wild ass from the stables of the Shah of Qazvin (and therefore probably from Persia), giving the shoulder height of the male as 50 ins. (1,269 mm.) and of the female as 44 ins. (1,127 mm.). These two specimens seem therefore to have been near the upper and lower extremes of the range of variation in the medium-sized races.

The Indian wild ass or Ghor-khar reaches about the same shoulder height as the Persian onager: males 1,168 mm. (3 ft. 10 ins.) (LYDEKKER, 1905 [i]; a specimen mistakenly attributed to the Persian race), 1,193 mm. (47 ins.) (JERDON, 1874, pp. 236–237); female 1,168 mm (46 ins.) (BLANFORD, 1891, p. 470).

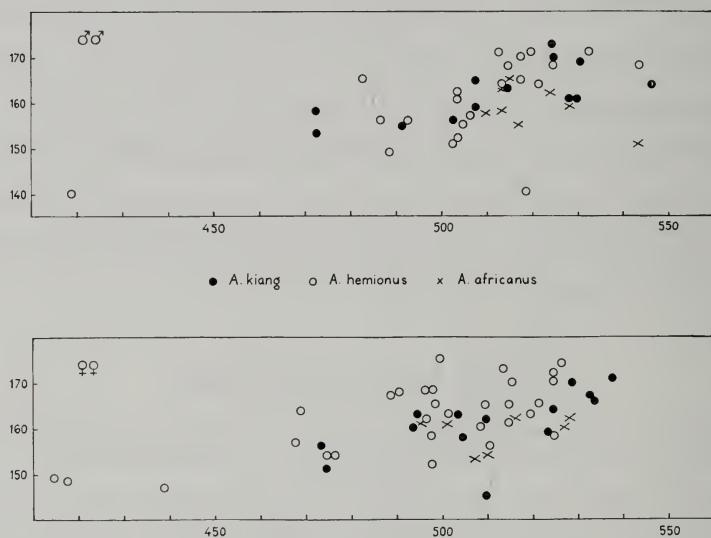


Fig. 6. Skull measurements of Afrikan and Asiatic Wild Asses. Ordinate — toothrow length; Abscissa — greatest length

There is no doubt that the biggest forms of the species are the wild asses of Mongolia and Siberia, to which the name Dziggetai is applied. PALLAS (1781, quoted by HARPER, 1945, p. 354) gives for a dziggetai the shoulder height of 3 ft. 10 ins. (1,168 mm.). It is quite evident, however, that Dziggetais can be much bigger. CARRUTHERS (1916) says that wild asses in West Mongolia stand 50 to 53 ins. at the shoulder (1,269 to 1,379 mm.). BANNIKOV (1954, p. 159) writes that the maximum shoulder height in the Mongolian Dziggetai is 1,300 mm. (51 ins.). Some years ago (1951–1953) there was a stallion of the Dziggetai in Prague zoo which came most probably from West Mongolia. This specimen was remarkably bigger than any Transcaspian (Turkmenian) wild asses reared in the zoo now. Unfortunately no exact measurements of this animal are available.

According to the material which is at the disposal of the authors of this paper, it seems that, as far as body size and skull measurements are concerned, there is no

difference between dziggetais from South Siberia and northern Mongolia and those from the more-southerly parts of Mongolia. i. e. Gobi dziggetais.

As already stated, the Syrian wild ass is characterised by very small size. Nevertheless, the size difference between this and the other forms of the species *hemionus* is not as great as usually believed: compare, for example, the shoulder height of 1,000 mm. in ANTONIUS's male *hemippus* with 1,080 mm. in the male Transcaspian kulan from the Prague zoo.

In the literature (e. g. SOKOLOV, 1959, HEPTNER et al., 1961, LANGKAVEL, 1897) there are, of course, numerous other body measurements, but in most of their data there is no indication as to how the measurements were taken. ALLEN (1940, p. 1282) for example gives measurements of three Gobi dziggetais in which the shoulder height varies from 1,333 to 1,372 mm. It is difficult, however, to compare ALLEN's data with the above mentioned ones, for they were taken on dead animals and so cannot express the shoulder height of a living animal when it stands.

Before proceeding to a sub-specific analysis for the available data, it will be useful to examine the question of vernacular names for animals of this species. A number of

names — Onager, Kulan, Ghor-khar etc. — are used to refer to one or another subspecies, without however inquiring as to what linguistic areas of the world employ what name. The name Kulan, for example, is used commonly to indicate the Mongolian races of the wild ass; but it appears that Kulan is a Kirghiz and Turkoman name, and thus applicable to the Transcaspian race, while the Mongols refer to their local form as Dziggetai. In Kutch the Indian wild ass is called Khur; while the Persian-derived term (BLANFORD, 1891, p. 470) is Ghor-khar, which will therefore be used to refer to the Persian race in Iran, and the Indian race in Pakistan. The Syrian wild ass, according to TRUMLER (1961) is locally known as Achdari.

There is a general impression, because of the manner in which local common names are used as the popular-scientific terms for different races, that Onager is a Persian word for wild ass. This is mistaken; it is a classical Greek word, ὄναγρος, a contraction of ὄνος ἄγριος, literally "Wild Ass". In Latin this became Onagrus or Onager, according to the common rules for Latinisation of Greek spellings, and was used to refer to the wild ass with which the Romans and Greeks were most familiar, namely the North African wild ass; it also had the meaning of a military engine for discharging large stones — perhaps from the kick of the machine. The Asiatic wild ass was referred to as ἡμιονος and mentioned as living in Anatolia by HOMER and in Persia by ARISTOTLE. (The literal meaning of this word is „Demi-Ass“, and it primarily signified a mule). The Vulgate refers to Syrian wild asses as Onagri, but it is not clear that the Greeks or Romans used the term for anything but African wild asses.

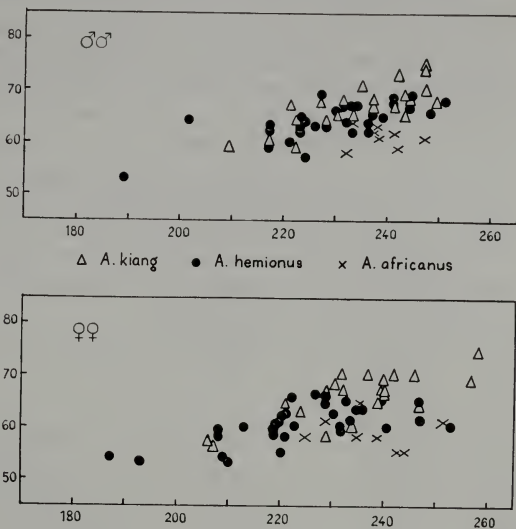


Fig. 7. Skull measurements of African and Asiatic Wild Asses. Ordinate — incisor breadth; Abscissa — palatal length

4.1. The large sized subspecies of *Asinus hemionus*

All the wild asses of Mongolia are currently classified as a single subspecies, usually given as *Equus hemionus hemionus*. There is however good evidence to suppose that there are two subspecies living in Mongolia, one in the Gobi desert (or rather semi-desert), the other in the more fertile, less arid areas in the shadow of the mountains from Lake Balkash to beyond Lake Baikal.

The only publication of recent years to suggest that two subspecies inhabit Mongolia is HARPER (1940), who however thought of them as being eastern and western rather than northern and southern. ALLEN (1940) mentions that LYDEKKER (1905 [ii]) had described a race *Equus onager castaneus* and Matschie another as *Asinus hemionus luteus*, and ascribed their description to a familiarity with the animals in one season only: summer for *castaneus*, winter for *luteus*. However, examination of the original descriptions shows that both the authors mentioned — particularly LYDEKKER — were perfectly familiar with the changes in colour involved in the change of coat.

The differences between what may be called the North- and South Mongolian dziggetai are at once apparent from examination of LYDEKKER's plates, 1905 (i) pl. 27

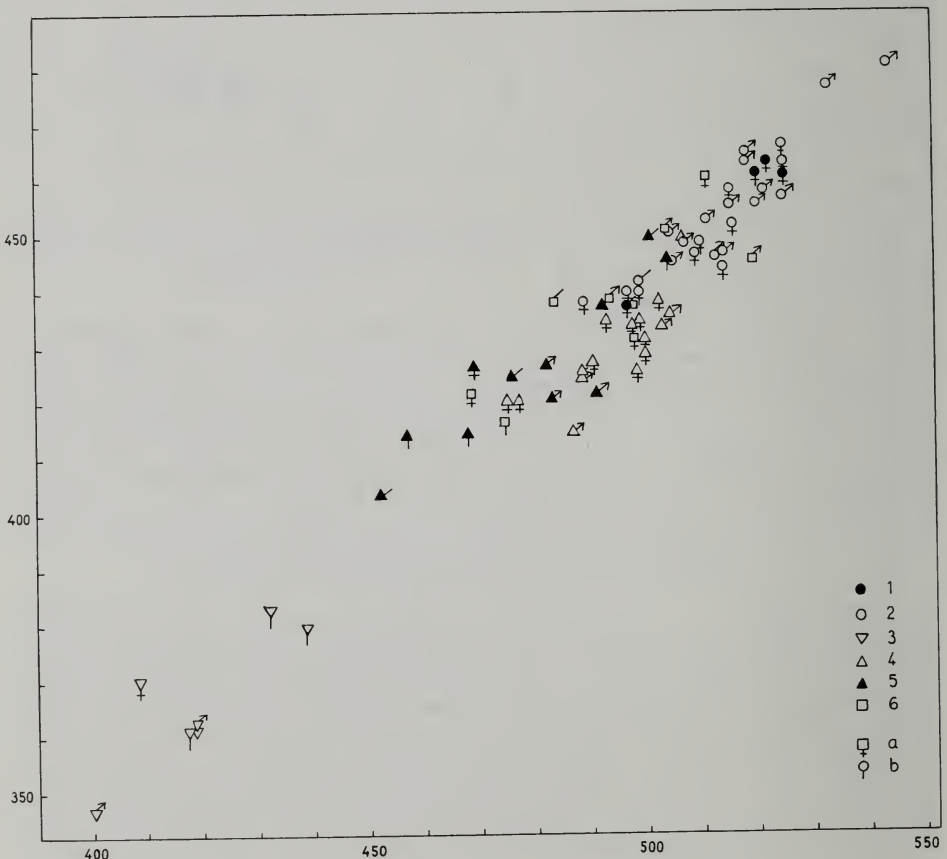


Fig. 8. Skull measurements of *Asinus hemionus*. Ordinate — basal length; Abscissa — greatest length. 1 = *A. hemionus hemionus*, 2 = *A. hemionus luteus*, 3 = *A. hemionus hemippus*, 4 = *A. hemionus kulan* ssp. n., 5 = *A. hemionus onager*, 6 = *A. hemionus khur*, a = Wild shot specimens, b = Zoo specimens

and 1905 (ii) pl. 18. These plates are labelled respectively *Equus hemionus* and *Equus onager castaneus*; according as to whether one felt the one or the other to represent the true *Equus hemionus* of PALLAS, so one would give a new name to the remaining one. LYDEKKER considered that his 1905 (i) plate was PALLAS's form, so described his 1905 (ii) plate as depicting the new form. It will be shown below that this interpretation was in error; but the differences between the animals depicted in the two plates are at once obvious. The Gobi, or South Mongolian form (1905 [i] pl. 27) has an intergrading pattern, a very pale buff on the upper side passing insensibly into the distinctly buff-toned colouration of the underside. As mentioned by LYDEKKER, this is true desert colouration. On the other hand the North Mongolian form (1905 [ii]

pl. 18) shows a strongly disruptive colouration, with the white of underside and buttocks clearly demarcated from the chestnut coloured upper side. Unfortunately neither of the specimens (living specimens brought back by a HAGENBECK expedition) on which the plates were founded had any closer locality than Kobdo, obviously a collecting centre rather than an actual locality of capture. It may be noted that a little later MATSCHIE (1911, p. 24), disagreeing with LYDEKKER's interpretation of PALLAS's *Equus hemionus*, rescribed the 1905 (i) pl. 27

type (here identified with the Gobi race) as *Asinus hemionus bedfordi*, as the animal was living on the estate of the Duke of Bedford.

Beyond the differences visible at a glance from the plates, further differences between the two Mongolian races may be mentioned. In the North Mongolian form there is a clear border on either side of the dorsal stripe; as in other races of *A. hemionus* which have a light-bordered dorsal stripe, this border becomes narrower with age and may even disappear (TRUMLER, pers. comm. to C. P. G.). On the other hand this border appears never to occur in the Gobi race, not even in young animals. The colour of the dorsal stripe varies in both from nearly black to pale chestnut brown, being lighter in young animals. Its width is usually about 55–70 mm. In no specimen examined by the present authors was a true shoulder-stripe observed, although in some specimens there is a little darker colouration on the shoulders which could hardly be called a „shoulder stripe“.

Of a great many skulls from the Gobi examined by the present authors, most have the orbit placed low on the skull profile. However, in the only five skulls of the North Mongolian race which are available, the orbit is relatively high-placed — as it is in all other *A. hemionus*. It would therefore appear that in several features the Gobi dziggetai is unique within the framework of *A. hemionus*: low-placed orbit, total lack of disruptive colouration, absence at all ages of any light colouration bordering

Table 4

Skull measurements of the type and paratype of *Asinus hemionus kulan* ssp. n.

	Type	Paratype
	National Museum Prague no. 10699 male	Zool. Museum of the Zool. Institute of Acad. Sci. U. S. S. R. Leningrad no. 19046 female
Greatest length	489	490.5
Basal length	425	427.3
Palatal length	227	220.5
Diastema length	80	77
Length of tooth row	159	167.5
Diastema breadth	50	44
Incisor breadth	69	62
Palatal breadth	57	65
Orbital breadth	192	200.5
Occipital breadth	50	49
Opisthion to inion	59	61
Nasal length	202	197.5

the dorsal stripe. An approach to the desert type of colouration is seen in the Syrian and Trukmenian wild asses.

In spite of the absence of locality records in LYDEKKER's two crucial plates and descriptions, there are sufficient exact records of specimens agreeing with the respective types to show that we are here dealing with two geographically replacing subspecies — i. e. neither mere colour-phases nor a case of sympatric species. All the Gobi locality records are from the desertic areas of southern Mongolia, extending into the

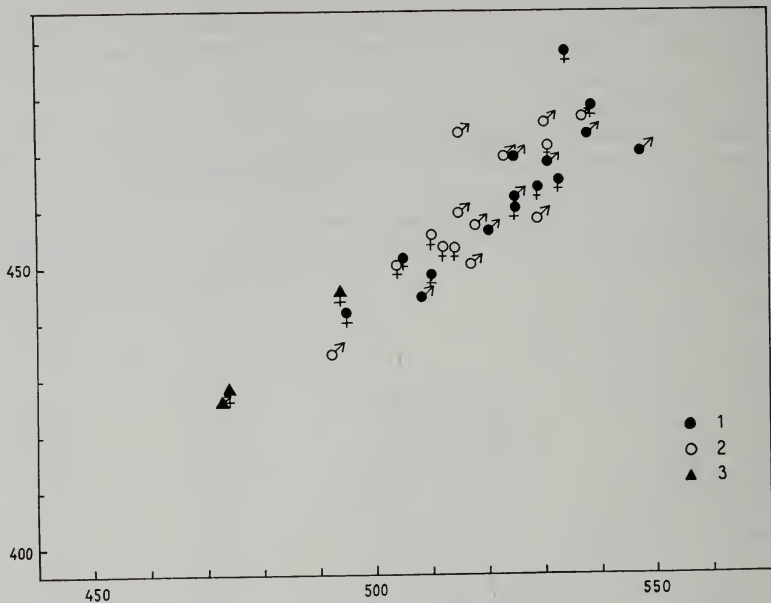


Fig. 9. Skull measurements of *Asinus kiang*. Ordinate — basal length; Abscissa — greatest length. 1 = *A. kiang holdereri*, 2 = *A. kiang kiang*, 3 = *A. kiang polyodon* — Only wild shot specimens

Chinese provinces of Sinkiang (Kichik-Ulan-Ussu) and Kansu (Surin-Gol); good descriptions of the external appearance are given by ANDREWS (1924) and MOTOHASHI (1931), the latter describing skins of all ages. The specimens from which these two writers made their descriptions have been examined by one of the present authors (C.P.G.) in the American Museum of Natural History, New York.

The records of the North Mongolian race, being fewer and more widely scattered, must be mentioned individually:

1. Abagaitui (eastern Transbaikalia): one mounted skin in Leningrad. (Two other mounted skins, also of this race, bear the label „Southwestern Siberia“).
2. Dauriya („Daourie“): one mounted skin in Leiden.
3. „Transbaikalia“: a mounted skin in Leiden, with skull.
4. „Dzungaria, near the Mongolian border“: a photograph taken by Professor BANNIKOV of a living animal, and kindly given to one of us (V.M.).
5. Ebi Nor: a juvenile skull in the British Museum, and a photograph of the same specimen, lying dead, in CARRUTHERS (1916).
6. Yandzhikhai, near Shi-Kho: a photograph in CARRUTHERS (1916).
7. Maiterek steppe, north of Zaisan Nor: a juvenile skin in Berlin, paratype of *Equus (Asinus) hemionus finschi* Matschie, 1911.
8. Northeast of Zaisan Nor: a skin in Berlin, holotype of *finschi*.



9. Ektag Mts., Dzungaria (250–300 km. southwest of Kobdo, i. e. about 45°35'N, 89°–90° E): NOACK (1902, p. 141) gives an exact description of a dziggetai „aus der Heimat der Wildperde“ which agrees excellently with the appearance of the North Mongolian race.

Other specimens almost certainly referable to this race are two female skulls in Leningrad labelled only „Dzungaria“, a juvenile skull (probably female) in Leningrad labelled „Desert Kirgisorum“, and a photograph in ANTONIUS (1932) of a zoobred animal whose parents were said to have come from the Irtysh lowlands, Semipalatinsk. Finally the type description of *Equus hemionus* Pallas, 1775, corresponds well with the appearance of this race, so that the type locality, Tarei Nor (Transbaikalia) can be safely added to the list of localities above.

It thus appears that the North Mongolian subspecies of *Asinus hemionus* is the nominate race, *A. h. hemionus*, with both *castaneus* Lydekker, 1905, and *finschi* Matschie, 1911, as synonyms. The race thus extends into the USSR at both ends of its distribution, as well as inhabiting northern Mongolia and part of Dzungaria (northernmost Sinkiang). All specimens examined are very similar: in summer the colour is darker and redder than any other race, with more contrast between light and dark areas than most others; while in Winter the coat is long, almost „shaggy“, with the red tones fading into a greyish colour towards the end of winter and in spring before moulting.

There is at present in the West Berlin zoo a wild ass stallion, caged with a female of the Turkmenian race, which is much larger than its mate and distinctly darker and redder in colour. This is the exact appearance of the nominate race; it would be interesting to know whether the specimen is really *A. h. hemionus* or an extreme specimen of the Turkmenian race. Both it and the female were reported to be from USSR territory; otherwise nothing is known of them.

For the Gobi race, two names are available: *bedfordi* and *luteus*, both of MATSCHIE, 1911. The first of these was based on LYDEKKER's (1905 [i]) plate of „*Equus hemionus*“ as explained above. Although showing the colour well, this specimen has no exact locality, and the fate of the animal's remains after death is unknown. The second name is based on two specimens of known locality (Surin-Gol) which are still in the Berlin Museum. Although they were shot on the 20th. and 23rd. of May respectively, during the spring moult, and the skins have therefore a rather nondescript appearance, the present authors have no hesitation in selecting the name *luteus* as valid name for the Gobi race in their capacity as First Revisers (following the suggestion of TRUMLER, pers. comm. to C.P.G.). It may be noted that SCHWARZ used the name *bedfordi*, but chose a type locality which is certainly incorrect and, in effect, used the name for the Turkmenian race. Although there are, as shown above, certain similarities between the Gobi and Turkmenian races, LYDEKKER's plate could not by any stretch of the imagination apply to the latter.

Therefore the Gobi dziggetai must stand under the name *Asinus hemionus luteus* (Matschie, 1911).

#### 4.2. The medium-sized subspecies of *Asinus hemionus*

The wild asses of the Indo-Iranian and Transcaspian territories represent the most difficult question in the taxonomy of the species. Not less than five different forms have been described from these parts of Asia. Currently, however, only one or two subspecies are usually recognised (cf. ELLERMAN & MORRISON-SCOTT, 1951, HALTENORTH & TRENSE, 1956; HEPTNER et al., 1961; MAZÁK, 1963, and others).

Some years ago, one of the present authors (MAZÁK, 1963) had accepted the one-

subspecies concept of the Indo-Iranian and Transcaspian wild ass populations. Nonetheless, a detailed study of the greater amount of material now available has shown that the problem is much more complicated.

As already stated above, all the wild asses of the territories in question are of about the same size, standing approximately 46–47 ins. at the shoulder. The detailed study of a series of skins (or living animals) and skulls from various localities has shown that three quite distinct groups may be distinguished according to their colouration, dark marking and skull structure: the first group includes the onagers of the Transcaspian semi-deserts, the second is formed of wild asses of the Iranian arid plateau, and the third consists of asses inhabiting (or having inhabited) the Thar semi-desert area, from the Rann of Kutch to the arid zone of north-west India and West Pakistan (Baluchistan).

With regard to the ground colouration, it can be stated that in all three above-mentioned groups it is rather light, representing a more or less expressed desert colouration; the material the present authors had at their disposal shows that this desert colouration is most advanced in the Transcaspian wild ass (Kulan); the other two races having a more disruptive pattern. The summer coat of the Kulan is very pale buff or sandy yellow, grading nearly insensibly into the white or slightly creamy colouration of the ventral area. On the contrary, the Iranian wild ass (Ghor-khar) shows more reddish shades in the ground colouration that might be determined as reddish buff or pinky-brownish-yellow. The colouration of the dorsal parts of the body grades into the whitish-buff or whitish pink-buff colouration of the underside; the transition of colours is, however, more conspicuous than in the Kulan. The extent of whitish areas seems to be somewhat larger than in the Kulan, in which the ground colouration reaches a little further down; however the Kulan has distinctly more white on the angles of the jaw.

There is a certain amount of variation in the above-mentioned features. For example, a young female Ghor-Khar in the Jardin des Plantes, Paris shows an insensible colour gradation in summer coat strongly reminiscent of a Transcaspian ass.

The wild ass of India and Baluchistan (Khur) is characterised by a somewhat darker colouration which presents distinct grey shades and varies from reddish yellow-grey to greyish fawn. The ventral area is white, sometimes with light greyish or cream tones. The transition of colours is the most abrupt of the three medium-sized forms, being very near to the disruptive pattern of *A. h. hemionus*. The extent of the white is rather great; the white wedges separating the ground colouration of the flanks from that of the thighs and shoulders are much broader than in the Iranian and Transcaspian forms; while the shape of the coloured area on the flanks is quite rectangular, instead of the more nearly square form seen in the other two medium-sized forms.

The longer winter coat of all three of these races is much darker in colour than the summer one, and in general it may be said that the colour differences are not so expressed as when the animals are in their bright and glossy summer hair, though the main distinctions are still observable. The colour of the winter coat varies from yellowish brown in Transcaspian kulans through reddish dark buff in Iranian Ghor-khars to the greyish pale chestnut of the Indian Khur. In all three the winter colour is much more disruptive in pattern than the summer one. The length of winter coat also varies: it is thickest in the Transcaspian, less thick but more curled in the Iranian, and hardly longer than the summer coat in the Indian.

The above mentioned colouration data are in full accordance with older descriptions of wild asses from the respective distribution areas (cf. the data summarised by HARPER, 1945, pp. 360 and 364, and the data given by Russian authors such as SOKOLOV, 1959, HEPTNER et al. 1961).

The dorsal stripe is rather broad in the three medium-sized forms; its width varies

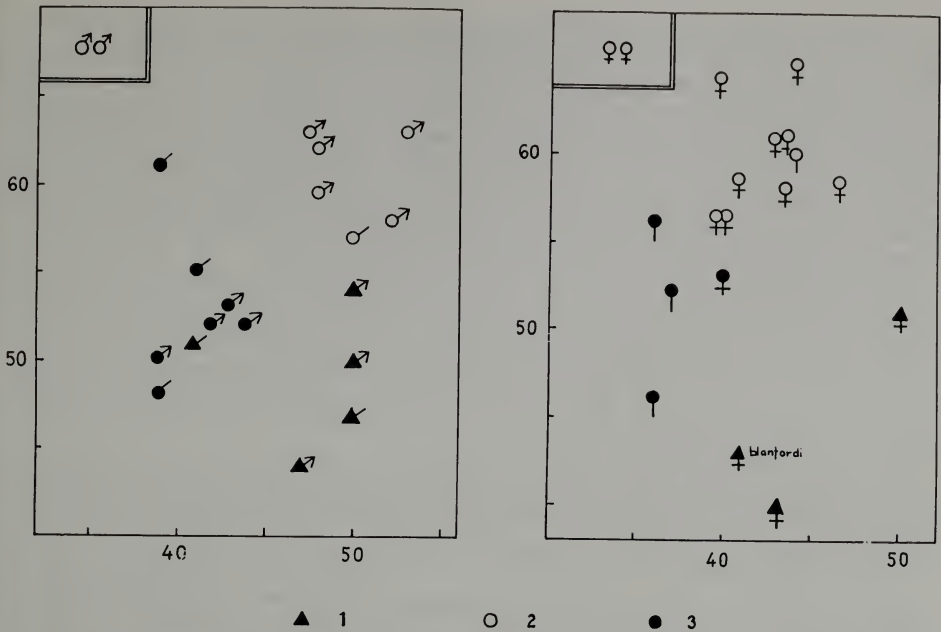


Fig. 10. Skull measurements of *Asinus hemionus*. Ordinate — palatal breadth; Abscissa — diastema breadth. 1 = *A. hemionus khur*, 2 = *A. hemionus kulan* ssp. n., 3 = *hemionus onager*

from about 60 mm. to about 90 mm., being usually broader in winter hair (70–90 mm.) than in summer (60–80 mm.). The colour of the dorsal stripe varies from very dark brownish black to pale chestnut, being often almost a light golden in the juvenile coat. In the Indian race the dorsal stripe does not extend down the tail to the tuft, unlike the Iranian and Transcaspien races; instead it ends on the tail-root or sometimes continues indistinctly to fade out half-way down the tail. This character seems to be very typical, and there were no exceptions in the material studied by the present authors.

In all three forms there is a somewhat lighter colouration bordering the dorsal stripe on either side, recalling the white one commonly seen in *A. h. hemionus*. This „light border“ is commonly clearer and broader in juveniles, becoming narrower and more obfuscated in adults; in some adults it disappears altogether.

The shoulder-stripe is an irregular and rather rare phenomenon which can appear in any of the Asiatic wild asses (as well as the African). Records of its occurrence are discussed by MOHR, 1961, p. 172, and MAZÁK, 1963, p. 283. Nevertheless, the Transcaspien and Indo-Iranian types seem to have a shoulder-stripe more frequently than the other races. The authors must make it clear that they have in mind the true, sharply outlined shoulder-stripe (see Fig. 1) since practically all of the wild asses preserve a certain degree of darker colouration on the shoulder.

The literature shows a degree of uncertainty as far as the presence or absence of the blackish ring just above the hoofs is concerned. The material available to the present authors shows that the Transcaspien and Iranian animals always have a more or less distinct ring above the hoofs, while it could not be found in any Indian specimens. The skins at the American Museum of Natural History show that in *A. h. luteus* the development of the hoof-ring is a character of maturity; so it would seem that in this respect, as in some others (especially skull structure) the Indian race shows the phenomenon of neoteny.

In skull features, as in external characters, the Indian race is well separated from the other two, which show less conspicuous but equally constant differences. In the Indian race the upper profile of the skull is very characteristic, with a convex neurocranium and concave nasal root area, while the nasals themselves are raised in their free portion. The highest point on the skull, when placed in the horizontal toothrow plane, is situated on the crown, well behind the orbits, whereas in the Iranian and Transcaspian specimens the crown is flatter, the upper profile less sinuous, and the highest point is situated just behind the orbits, on the level of their posterior margins. The skull of the Indian wild ass thus preserves juvenile features.

Comparing the Transcaspian and Iranian wild asses, there is a good difference in the shape of the occiput, which is more elongated in the former. This character is quite typical and can be very well shown by the ratio of Occiput breadth to Distance from opisthion to inion (Fig. 11). In addition the orbit is rather low-placed in the Kulan, recalling (less markedly) the Gobi dziggetai, while in Iranian Ghor-khars it is placed relatively high as it is in the Indian Khur. Finally the skulls of Kulans average larger than those of the Ghor-khar.

All the above differences in colour and marking as well as in skull structure indicate quite clearly that the above described wild asses represent three distinct subspecies of *Asinus hemionus*.

Some twenty years ago Pocock (1947, p. 143) described two new forms of Asiatic

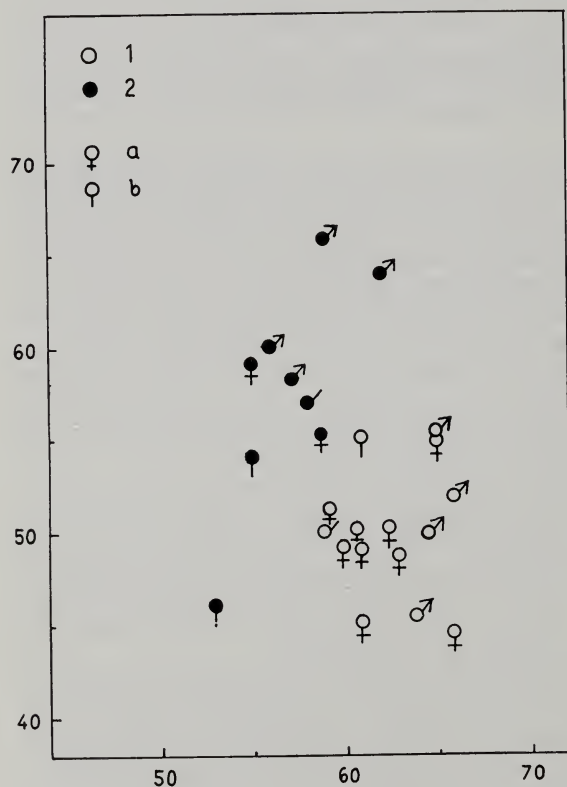


Fig. 11. Skull measurements of *Asinus hemionus*. Ordinate — occipital breadth; abscissa — opisthion to inion. 1 = *A. hemionus kulan* ssp. n., 2 = *A. hemionus onager*, a = Wild shot specimens, b = Zoo specimens

wild asses from Persia and Baluchistan respectively: *Microhippus hemionus bahram* (type locality Yezd, Central Persia, 32°N, 55°E) and *Microhippus hemionus blandfordi* (type locality Sham Plains, 29°20'N, 69°40'E). When examining Pocock's type specimens the present authors found that the type and referred skins of *bahram* show all the typical features of other Iranian specimens, being perhaps somewhat darker in colouration than usual. The type specimen of *blandfordi* is, however, not entirely identical to any previously described forms. It is nearest to the skins from Kutch, showing the typical Indian race's distribution of colours, and a dorsal stripe which fails to reach to the tail tuft. Unfortunately, the legs are cut in this specimen and it is therefore not possible to see whether there is a hoof-ring or not. The most marked differences from the Indian wild ass are in the skull, which is low-crowned with a straight profile.

In a previous paper, one of the present authors (GROVES, 1963, pp. 335—336) suggested that *M. b. blanfordi* represents a hybrid between a kiang and the Indian wild ass. It is now known that the altitudes at which kiangs are found, and have always been found, are too great for them ever to have come into contact with herds of *A. hemionus*, at any rate in Baluchistan; and that the skull features of the BLANFORD specimen are not reminiscent of the kiang alone, but of the Iranian wild ass as well (at the time of writing his 1963 paper, GROVES had seen no wild-shot Iranian skulls, only the pathological zoo specimens in the Paris Museum). It is therefore here suggested that the type of *M. b. blanfordi* represents, not a hybrid but rather an intergrade, and it is pointed out that the Sham Plains are at the foot of the Iranian Plateau, where it extends into Pakistan, and that the edge of the plateau would doubtless form no great barrier to interbreeding. In order to fix the name, it is here proposed that the name *blanfordi* be placed in the synonymy of the Indian race, not the Iranian, as it is rather nearer to the Indian form.

In examining the question of nomenclature, it is found that there are five valid names given by various authors to wild asses in the medium-sized group: *Equus onager* Zimmermann, 1780, or *Equus onager* Boddaert, 1785 respectively; *Equus khur* Lesson, 1827; *Asinus hamar* H. Smith, 1841; and POCOCK's two names discussed above (there are also certain names which can be placed as objective synonyms for one or the other of *onager* or *khur*).

HARPER (1940, pp. 198—199) concludes that the name *onager* should date from BODDAERT (1785) since „Zimmermann (1780:80) merely cites a polynomial from BRISSON“. HERSHKOVITZ (1948, p. 277) and currently LAY (1967) are, however, of the opinion that ZIMMERMANN's name can be used as a valid one. LAY (1.c.) writes: „... ZIMMERMANN ... cites BRISSON (1762:62) which is not binomial but modifies BRISSON's word order to fit his own consistently binomial scheme.“ The present authors checked the question of the name *onager* Zimmermann again and have studied the respective relevant literature. They found that ZIMMERMANN's name can really be interpreted as a binomial, though not quite explicitly. ZIMMERMANN (1780, p. 80) states: „*Der Esel. Asinus / Equus (Onager) auriculis longis, iuba brevi, pelle tuberculis parvis scabra. Brisson, Regn. Anim. p. 104, n. 5.*“ This quotation shows that the name could be interpreted as a binomial only if we accept as the generic name the word *Equus* and not *Asinus*, the latter being a part of the heading of the respective paragraph. Nonetheless, when accepting the word „*Equus*“ as the generic name, there is an other problem: ZIMMERMANN's description is good enough for any form of both African and Asiatic Wild Asses and there is nothing which could make the question clearer, except the quotation of BRISSON's work. BRISSON (1762, p. 62) describing the wild ass, gives also no more detailed data, and it is true that ZIMMERMANN (1.c.) really only quotes BRISSON's words. Brisson gives, however, some references, the first of them being 6th edition of LINNAEUS's „*Systema Naturae*“ (1748, p. 11), which means that BRISSON refers to LINNAEUS's *Equus asinus*. Among other sources given by BRISSON, there is also RAY's (1693) „*Synopsis Methodica Animalium Quadrupedum et Serpentinum Generis*“, which is quoted also by LINNAEUS and is, in fact, his only source. RAY (1693, p. 63) writes: „*Hunc ab Asino domestico non alter differre existinasset, quam ut ferum & sylvestrem a cicuri & mansueto, ni Clarissimi Viri Petrus Bellonius in Observationibus & Leonh. Rauwolfus in Hodoeporico, qui eum viderunt, pro diversa specie habuissent. Quorum hic in Syria circum Halepum & Apamiam frequentes esse scribit, eorumque pelles robustas & durabiles, nec attritu faciles esse; exterius, prout ibi a coriariis, parantur, superficie tuberculis parvis scabra, Fragi fere ad instar; iisque uti Artifices ad ensium vaginas & cultrorum thecas. Chagrin vocant.*“ Now, it is obvious that RAY refers to asses living in Syria but again, it is not quite clear which form of ass he is writing about. All these facts show that there is a great deal

of uncertainty as far as ZIMMERMANN's name is concerned. It would seem that ZIMMERMANN's name, in fact, refers, via BRISSON, LINNAEUS and RAY, not to the Iranian wild ass, but to the Syrian. This interpretation, however, is very speculative; considering that ZIMMERMANN uses in his description a heading „*Der Esel. Asinus*“, applying thus a common German as well as Latin name, we can presume he meant the Ordinary ass.

On the contrary, there is no difficulty connected with the name by BODDAERT. BODDAERT's (1785) *Equus onager* was founded on the basis of PALLAS's work which, as shown below, refers quite clearly to the Persian (Iranian) wild asses.

All the above mentioned reasons lead the authors of this paper to the conclusion that, in the interests of nomenclatorial stability as well as fact-probability, ZIMMERMANN's name can not be used as a valid one and it is here looked upon as a *nomen nudum*. Then, the only available name is that of BODDAERT.

BODDAERT (1785, p. 160) used the name *Equus onager* on the basis of PALLAS's (1780) description of two living captives, male and female, from the stables of the Khan of Qasvin. HARPER (1940, pp. 198–199) restricted the type locality to the Mountains about Kasbin (= Qasvin). TRUMLER (1691, p. 118) however disagrees, stating that these mountains are not suitable country for wild asses; that the informants who gave this locality to the European inquirer (HABLIZL) were probably giving a positive answer only because of Persian standards of politeness; and that in the 1780's the rulers of Qasvin were politically rivals to other Persian rulers, but had trade links with the Turkoman peoples. He therefore suggests (Trumler, l.c.; and pers. comm. to C.P.G.) that the animals used as basis for the name *onager* are rather more likely to have come from Turkmenia than from Iran (Persia). There is, however, as shown on large-scale maps of Iran, an arm of the desert (i. e. good wild ass country) which extends into Qasvin province, approaching the city itself. The proximity of wild ass country would make it seem, *a priori*, that the specimens in question were, in fact, of the Persian race. Besides which the description given by HARPER (mainly from HABLIZL) agree rather better with the Iranian subspecies. This interpretation of the type locality is in agreement with that of LAY (1967) who visited Qasvin three times and says: „The city lies in flat basin, which is a northeastern extension of the Dasht-i-Kavir basin, about 13 Kilometers south of the Elburz mountain escarpment. The surrounding area is densely inhabited by man, and wild ass no longer occur in the

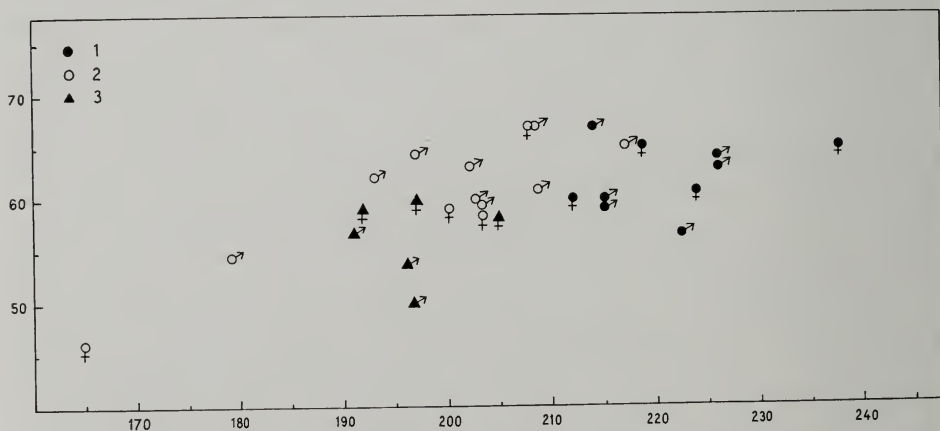


Fig. 12. Skull measurements of *Asinus kiang*. Ordinate — nasal breadth; Abscissa — nasal length. 1 = *A. kiang holdereri*, 2 = *A. kiang kiang*, 3 = *A. kiang polyodon* — Only wild shot specimens

vicinity, however, according to PALLAS (1780, 259–273) these animals doubtlessly did in the past. Their habits of taking refuge in the rougher higher country bordering basins is probably the basis of HABLIZL's observations of herds in the Qazvin mountain valleys. The physical structure of the Elburz system is such that 'valleys' — water courses would provide a more appropriate description — open directly onto the plain north of Qazvin. It is these erosions that wild ass likely inhabited though it is doubtful that they ever will again."

There is thus no doubt that the name *onager* should continue to be used for the Iranian wild ass.

As far as the name *hamar* is concerned, it is quite clear that HAMILTON SMITH's description refers equally to the Iranian race. The problem of this form was discussed extensively by HARPER (1940, pp. 199–200) and MAZÁK (1963, pp. 289–291), the former restricting the locality to the northern part of the province of Fars, „between Yezdikhast and Shulgastan“.

LESSON's name *khur* is always taken to refer to the Indian wild ass, and this is probably correct. He says it is „nomée KHUR par les Persans“, and „son pelage est d'un gris cendre au dessus, passant au gris sale en dessous“, both of which statements at once indicate the Indian race. No locality is given beyond „les deserts de l'Asie du nun“<sup>3</sup>; and curiously DUVAUCEL's specimens from Industan are mentioned not under *Equus khur* but *E. hemionus*.

Although there are thus some synonyms for both Iranian and Indian races, there is no name available for the Transcaspian form, though this is by now well known to mammalogists and is usually referred to under the name *onager* (though HARPER, 1945, referred to all wild asses from Russian Central Asia as *Asinus hemionus finschi*). Since the present authors have found that the Transcaspian wild ass represents a distinct subspecies, it is necessary to give it a name.

*Asinus hemionus kulan* subsp. nov. Transcaspian wild ass or Kulan

*Type locality*: Badkhyz Reserve, Turkmenia, USSR (ca. 35°50'N, 61°40'E).

*Type specimen*: Adult male, mounted skin, and skull; died in Prague zoo on January 28th., 1962. National Museum in Praha (Prague); Nos. 10698 (skin) and 10699 (skull). Purchased from Prague zoo.

*Paratype*: Adult female, skin and skull; Turkmenia, valley of the Er-Oilak-Duz Lake, Serakhsk-Kushka distr., 26. X. 1935; coll. ROZANOV; Zoological Museum of the Zoological Institute of Academy of Sciences of USSR in Leningrad, no. 19046. External measurements: head & body (over curves) 2,270 mm.; tail 410 mm.; ear 185 (205) mm.; hind foot 470 mm.

*Derivation of name*: „Kulan“ is a vernacular name of Kazakh and Turkoman origin commonly used by Russian zoologists for the Transcaspian wild ass.

*Specimens examined*: 17 skulls (6 male, 11 female), 6 skins, 19 living specimens. Skins and skulls are preserved in following institutions: Zoological Museum, Moscow; Zoological Museum, Leningrad; National Museum, Prague; Zoologische Staatssammlung, Munich.

*Skull measurements*: See tables 1 and 4.

*Description*: *Asinus hemionus kulan* is of medium size, shoulder height being from 1,080 mm. to 1270 mm. In the type specimen, when alive, the height was about 1,120 mm. (3 ft., 8 ins.).

<sup>3</sup> We presume that „nun“ (as it is printed in italics) is an attempt to write the English word „noon“ without knowing that „noon“ does not have the same meaning of South that „midi“ has.

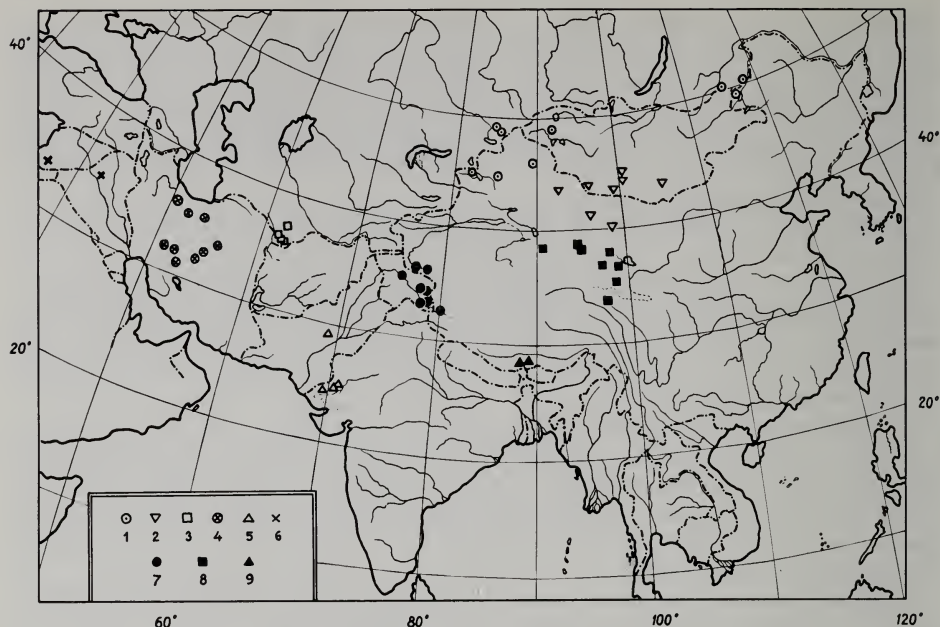


Fig. 13. Distribution of individual subspecies of *Asinus hemionus* and *Asinus kiang*. 1 = *A. hemionus hemionus*, 2 = *A. hemionus luteus*, 3 = *A. hemionus kulan* ssp. n., 4 = *A. hemionus onager*, 5 = *A. hemionus khur*, 6 = *A. hemionus hemippus*, 7 = *A. kiang kiang*, 8 = *A. kiang holdereri*, 9 = *A. kiang polyodon* — Only precisely known localities are marked on the map

The type specimen is in winter hair which is about 25 mm. in length. The general character of colouration is rather disruptive. Upper parts of body yellowish brown, the colour being most intensive on the flanks. Ventral body nearly white, with a light cream shade. Mane, tail tuft and dorsal stripe are deep chestnut brown and latter runs from caudal part of mane up to the very tail tuft, being in lumbosacral region about 80 mm. broad. Above the hoofs is a distinct, narrow blackish ring. No shoulder stripe is present, in type specimen.

Summer colour of this race is much paler, being pale buff or pale sandy yellow and lacking the sharp contrast between light and dark areas seen in winter coat. The ground colouration grades nearly insensibly into the white or light creamy-white colouration of the underparts.

For the general distribution of colours, see figs. 1 and 2.

The skull of *A. b. kulan* is characterised by the elongate occipital region (see fig. 11) and relatively low-placed orbit. The highest point of the skull is situated just behind the orbits on level of their aboral edge.

*Distribution:* All specimens examined came from the southern parts of Turkmenia (Badkhyz reserve, Er-Oylak-Duz, Kasha Ganga). The older literature (ANTONIUS, 1932, SOKOLOV, 1959, and others) and some photos which the present authors had at their disposal indicate, however, that this race inhabits (or inhabited) all the desartic area of Turkmenia and former Bokhara and apparently also the northwesternmost parts of Afghanistan where it is separated from the Iranian onagers by the westernmost chains of the Hindu Kush. Along the Irano-Turkmenian border undoubtedly there is intergradation, as the Elburz range in that area is low and would act as a poor barrier to gene-flow. LYDEKKER's (1904 [ii]) plate 19, of an animal from Meshed (p. 589), is recognisably of the present race, though referred to as *Equus onager indicus*.



The most important references for the new race are as follows: ANTONIUS, 1932; HEPTNER et al., 1961; MAZÁK, 1963; SOKOLOV, 1959.

#### 4.3. The small sized subspecies of *Asinus hemionus*

The small sized group of *A. hemionus* includes only one race, the well-known Syrian wild ass or Achdari, *A. b. hemippus* I. Geoffroy, 1855, of which the mounted skeleton of the type specimen is on public exhibition in the Galerie d'Anatomie Comparée in Paris. It cannot possibly be confused with any other race, being relatively well separate by its small size alone: the largest known skull, in Harvard, measures 439 mm. in greatest length, while the smallest wild-shot skull of any other race is 468 mm. long (*A. b. kbur*, in British Museum).

In colour this race somewhat resembles *A. b. luteus*, having an intergrading desert colouration which is more extreme in summer. RAWLINSON (1862, quoted by KEIMER, 1949) gives the colour of this race as grey-white in winter to bright bay, approaching pink, in summer. The winter coat, to judge from a mounted skin in Paris, is little longer than the summer coat: it is a light reddish colour, the summer skin in London being more tawny-olive, i. e. not as bright as described by RAWLINSON; but since the skin is stiff and untanned there may well have been some deterioration. Characteristic of this race, as seen by the Paris skin, the two London skins (one is that of a foal) and the pictures published by ANTONIUS (1928), is that the dark areas on the flanks extend further down than in any other race, so that the light (but not white) ventral colour is almost restricted to the belly itself.

It appears possible — from very few skulls — that in this race alone among the races of *A. hemionus* the females may show a larger size than the males. The only wild-shot male skull seen by either of the present authors measures 419 mm. in greatest length, while two wild-shot females measure 418 and 439 mm.; two males from Schönbrunn zoo, Vienna, measure 400 and 419 mm., while three females from captivity (two from Schönbrunn, and one, the type, from Paris) measure 409, 415 and 432 mm. In both wild and captive cases, therefore, the females average larger than the males.

This race is thought to be extinct. Though persistent reports of its continued existence cannot entirely be discounted, there has been no proof of living specimens since 1927 (TALBOT, 1960). The listing of a pair in the Wellington zoo, New Zealand, in the first volume of the International Zoo Yearbook would seem to be an error.

The distribution of this subspecies is said to extend from Palestine to the Zagros range, Iran (the traditionally defined border between this race and the Iranian onager); but actually locality records are very few. It is definitely known from Damascus (type locality of *Equus hemionus* var. *syriacus* Milne-Edwards, 1869) and other parts of Syria, Assyria (RAWLINSON), and Mesopotamia (British Museum skin).

#### 4.4. List of subspecies of *Asinus hemionus* (Pallas, 1775)

The six subspecies of *Asinus hemionus* may be characterised as follows:

1. *Asinus hemionus hemionus* (Pallas, 1775). PALLAS's or North Mongolian dziggetai  
1775: *Equus hemionus* Pallas, Nov. Comm. Ac. Sci. Petrop. 19, p. 397. Tarei Nor, Transbaikalia (50°N, 115°E).  
1904: *Equus onager castaneus* Lydekker, Novit. Zool. 11, p. 590. Supposedly from Kirghis Nor, Kobdo, Mongolia.

1911: *Equus (Asinus) hemionus finschi* Matschie, in FUTTERER: *Durch Asien*, 3, Zool. Nachtrag, p. 24. Northeast of Zaisan Nor.

*Distribution*: Southwestern Siberia, valley of Lake Balkash, valley of Lake Zaisan, Dzungaria, more westerly parts of Mongolia, northern Mongolia, Transbaikalia and (apparently) northwesternmost parts of Manchuria.

*Localities*: Transbaikalia (includes Abagaitui and Tarei Nor), Dauriya, Kobdo (?), Dzungaria, Ebi Nor, Zaisan Nor and Maiterek steppe, southwestern Siberia (includes Irtysh lowlands in the Semipalatinsk area).

*Description*: a large race of rather dark yellow-brown colouration of typical disruptive character especially in winter; dorsal stripe bordered on either side with white (disappearing with age); orbit placed high.

#### 2. *Asinus hemionus luteus* (Matschie, 1911). Gobi dziggetai

1911: *Equus (Asinus) hemionus luteus* Matschie, in FUTTERER: *Durch Asien*, 3, Zool. Nachtrag, p. 24. Surin Gol, Kansu, China.

1911: *Equus (Asinus) hemionus bedfordi* Matschie, loc. cit., p. 23. Supposedly from Kobdo, Mongolia.

*Distribution*: Desert areas of southern Mongolia (Gobi) and parts of the Chinese provinces of Sinkiang and Kansu.

*Localities*: Tsagan Nor, Gobi Altai, Loh, Artsa Bogdo, Ikhe Bogdo, Kichik-Ulan-Ussu, Surin-Gol.

*Description*: a large race of about the same size as the nominate race; colour pale sandy of an advanced desert character, grading into the lighter colour below; no light border to dorsal stripe; orbit tends to be low-placed on skull.

#### 3. *Asinus hemionus onager* (Boddaert, 1785). Iranian (Persian) wild ass; Ghor-khar

1780: *Equus onager* Zimmermann, *Geographische Geschichte d. Menschen u. d. vierfüßigen Thiere*, Bd. 2, p. 80, *nomen nudum*.

1785: *Equus onager* Boddaert, *Elenchus Animalum*, 1, p. 160. "Mountains about Kasbin": more likely the desert south of Kasbin (Qasvin).

1841: *Asinus hamar* H. Smith, *Jardine's Naturalist's Libr.*, Mamm., 31, p. 351. Persia, Province of Fars, between Yazd-i-khvast and Shurjestan (Shulgastan).

1879: *Asinus dziggetai* Wood, *Natural History*, London, p. 138. Persia.

1947: *Microhippus hemionus bahram* Pocock, *J. Bombay N. H. Soc.*, 47, p. 143. Yezd, central Persia.

*Distribution*: plateau of Iran, on west up to Zagros range, on northeast to western Afghanistan south of Siah Koh range, on southeast probably into Pakistan.

*Localities*: Abaguh, Siah Parde near Teheran, Siah Kuh (west of Teheran), Yezd, Chabeiky, Marvast, Dasht-i-Kavir, environs of Semnan, Chah Ali Khan (Damghan Prov.).

*Description*: a medium sized race of rather pale yellow-brown colouration with light reddish or pink shades; blackish hoof-rings present; dorsal stripe extends to tail-tuft; highest point of skull placed just behind orbits; occipital region of skull short; orbit placed high.

#### 4. *Asinus hemionus kulan* ssp. nov. Transcaspian wild ass; Kulan

*Distribution*: Transcaspia (includes Turkmenia and former Bokhara) and apparently the northwesternmost parts of Afghanistan (north of Siah Koh range). Introduced also on Barsa Kelmes I., Aral Sea.

*Localities:* Badkhyz Reserve, Er-Oylak-Duz and Kasha Ganga (both in Serakhsk-Kushka district), Merw, Meshed.

*Description:* A medium-sized race of pale sandy-yellow colour, darker in winter; summer coat shows typical desert-type intergrading of colours; blackish hoof-rings present; dorsal stripe extends to tail-tuft; highest point of skull placed just behind orbits; occipital region strongly elongated; orbit rather low-placed.

#### 5. *Asinus hemionus khur* (Lesson, 1827). Indian wild ass; Khur

1827: *Equus khur* Lesson, Manuel de Mammalogie, p. 347. Little Rann of Kutch, India.

1862: *Asinus indicus* Sclater, P.Z.S. London, p. 163. *nom. nud.*

1869: *Equus indicus* George, Ann. Sci. Nat. Zool. 12, p. 35.

1947: *Microbippus hemionus blanfordi* Pocock, J. Bombay N. H. Soc., 47, p. 144. Sham Plains, Baluchistan. (Actually an intergrade with *A. h. onager*).

*Distribution:* the Rann of Kutch and parts of the desert zone of northwest India and West Pakistan.

*Localities:* the Rann of Kutch; Thar Parkur, Sind; Sham plains, Baluchistan (intergrade with *A. h. onager*).

*Description:* A medium-sized race of greyish-fawn or reddish yellow-grey colour, winter hair darker and very little longer than summer; colour of underside extends rather high on flanks; no hoof-rings at any time in life; dorsal stripe ends at base of tail or halfway down it; highest point of skull placed far behind orbits, due to rounded crown; orbit high-placed; profile sinuous, with raised nasal ends.

#### 6. *Asinus hemionus hemippus* (I. Geoffroy, 1855). Syrian wild ass or Achdari

1855: *Equus hemippus* I. Geoffroy, C. R. Acad. Sci. Paris, 41, p. 1214. Syria.

1869: *Equus hemionus var. syriacus* Milne-Edwards, Nouv. Arch. Mus. Hist. Nat. Paris, 5, Bull., p. 40, pl. 4. Damascus, Syria.

*Distribution:* Desert parts of Syria and Iraq. Extinct (?).

*Localities:* Damascus, Aleppo, „Mesopotamia.“

*Description:* Small race with intergrading desert colouration which is light tawny-olive in summer and reddish pale sandy-yellow in winter; white colour of underside is restricted to belly; dorsal stripe runs to tail tuft; hoof-rings present; skull small, with high crown, concave profile with raised nasal ends, and high-placed orbit.

### 5. *Asinus kiang*: the Kiangs or Tibetan wild asses

The species *Asinus kiang* is represented by somewhat larger and more robust forms which inhabit the high plateau of Tibet.

Kiangs are characterised by their much darker ground colouration than in the species *Asinus hemionus*. Behind the shoulders there is a very typical wedge of white colour which reaches very high in the dorsal direction; ventrally, this wedge broadens out in a caudal direction, so that the antero-ventral corner of the patch of colour on the flanks is cut away and rounded, instead of presenting an angular appearance as in *A. hemionus*. The white of the undersides is very extensive on the neck, where it almost reaches to the mane. On the buttocks the white is restricted to the posterior surfaces, and infused with the reddish of the body colour, whereas it is normally rather sharply marked off in *A. hemionus*.

All kiangs show a very distinctive disruptive type of colouration. The winter coat is much longer than the summer coat and is somewhat wavy; the summer coat is in all

forms a striking reddish colour, and the winter coat is darker and browner. The mane and tail are black or very deep blackish brown; the tail possesses long hairs on the lateral surfaces almost to the root, and the mane also is longer than in *A. hemionus*. The dorsal stripe runs from the aboral end of the mane up to the tail-tuft. In some specimens there is a more or less distinct shoulder-stripe, the outlines of which may not be very sharp (cf. MAZÁK, 1963, figs. 1–4). The dorsal stripe is somewhat narrower than in the species *A. hemionus*, averaging from 35 to 65 mm. in summer coat and 40–75 mm. in Winter. Above the hoofs there is always a distinct blackish ring.

In body build, the kiang shows certain distinct differences from the Onagers, which were first pointed out by ANTONIUS (1932). The rump in the kiang is narrow, steeply-descending, as in the African wild ass and domestic donkeys. In *A. hemionus* the rump is broader, more rounded, and more horse-like; in *A. h. hemippus* there is, however, a certain contrast with other subspecies in the rather narrower rump which is however more horizontal than in *A. kiang* (ANTONIUS, *ibid.*).

As for the size kiangs can reach, there are only a few exact data. A male living currently in the Prague zoo, which came from the Kukunor region of China stands, at 7 years of age, 1,390 mm. (54.75 ins.) at the shoulder. PRZEWALSKY (1875, ed. 1946, p. 237) gives the shoulder height for a kiang from Eastern Tibet as 1,410 mm. (55½ ins.). According to the skull dimensions it would seem probable that kiangs from the western parts of the distribution area (Ladakh, western Tibet) are just a little smaller than eastern kiangs, while specimens from southern Tibet would be considerably smaller; the latter expectation is borne out as HODGSON (1847) gives the heights of a male and female from the type locality of his *Asinus polyodon* as 3 ft. 9 ins. and 3 ft. 5 ins. respectively (1,137 and 1,040 mm.). These rather surprisingly small sizes bear out the impression from subjective observation that the kiang is a large-headed animal.

A detailed study of all available material shows that there are three quite well-distinguishable subspecies of *Asinus kiang*. The problem of these subspecies is discussed below.

### 5. 1. A note on *Hemionus kiang nepalensis* Trumler, 1959

The well-known study by TRUMLER (1959) on the kiang was the first in recent years to seriously raise the question of whether or not the kiang should be regarded as a distinct species, by demonstrating the probable existence of geographic variation within the Tibetan region. That his resuscitation of MATSCHIE's subspecies *holdereri* is valid is shown below; also that there is another subspecies — *A. k. polyodon* Hodgson, 1847 — not recognised by TRUMLER. The question must be settled, however, of the validity of the race *Hemionus kiang nepalensis* described for the first time in TRUMLER's paper.

TRUMLER (p. 20) says of the four skulls which, together with two skins, formed the paradigm of his race,

„Diese Schädel wirkten im ersten Anblick wie Pferdeschädel; sie sind sehr schlank und langgestreckt, und wären nicht die beiden Felle gewesen und ein weiteres Beweisstück, auf das ich weiter unten zu sprechen kommen werde, so hätte ich sehr daran gezweifelt, ob ich es tatsächlich mit Kiangs zu tun hatte“.

The „weiteres Beweisstück“ refers to records of a living specimen of a Nepal kiang which lived in the London zoo, and the skull of its offspring with an East Tibetan kiang in the Vienna Museum (this skull could not be found when one of the authors [C. P. G.] was in Vienna).

TRUMLER's four specimens are as follows:

1. B. M. no. 58. 6. 24. 119. Holotype, skin and skull. HODGSON collection; “Sikkhim”.
2. B. M. no. 58. 6. 24. 150. Skull only; also from Hodgson collection.

3. B. M. no. 91. 10. 7. 176. Skin and skull. Collected by MANDELLI in Sikkhim, presented to the museum by BLANFORD. The skull lacks its hinder portion.
4. B. M. no. 48. 6. 11. 18. Earlier catalogued as 976 c. HODGSON collection; skull only (juvenile). Said to be from Nepal.

A fifth skull, in Paris, was referred to this race, but the locality is given as only "Central Asia". Examination of the four British Museum specimens reveals some very surprising discrepancies:

First, the skull and skin of the holotype are most certainly not from the same animal. The skull is perfectly adult; the skin is that of a foal, as shown by its very small size and the nature of its coat. In this connection it is interesting to note that LYDEKKER (1916, p. 10) catalogues under this number "Skull and skin, immature".

Secondly, the difference in size between specimens (1) and (2) above is most remarkable; TRUMLER also comments on it. The second is 46 mm. smaller in its greatest length than the first; the greatest length difference in other kiangs is found in females of the east Tibetan race, where the largest skull is 43 mm. longer than the smallest; in other samples the difference is less. The statistical probability of finding two specimens in a sample of two at the extreme ends of the potential range of variability must be very slight; yet this appears to be the case in the Nepal kiang skulls, as the two mentioned are the only two complete, adult skulls of recorded locality.

Thirdly, specimen (4) on the list is in series with skulls no. 48. 6. 11. 16 and 48. 6. 11. 17 which are labelled as co-types of *Asinus polyodon* Hodgson, 1847. On these two skulls the original localities were written as "Nepal", but a later label says "probably Hundes". It seems logical that whatever information applies to them should apply also to 48. 6. 11. 18 (no. 4 on the list above); it merely happens, however, that the label "Nepal" had not been changed on the latter skull.

Fourthly, it must be stated that although the chief and most striking distinguishing feature of *nepalensis* is the rounded, horse-like occiput, the Mandelli skull (no. 3 on the list) lacks an occiput and the young skull (4) has a square occiput like other kiangs and indeed like all other asses; so that the description of the occiput given for *nepalensis* in effect applies to specimens (1) and (2). Nor are nos. (3) and (4) „sehr schlank und langgestreckt“, nor have the extremely forwardly-inclining incisors as said to characterise *nepalensis*.

From the facts the most logical conclusions are the following:

1. That the type specimen consists of a skin and skull which were wrongly associated, the skin being that of a young kiang and the skull that of a horse (a Tibetan pony); as TRUMLER himself noted, it was really only the skin which made him think it was a kiang (and the existence of other specimens said to be from Nepal and Sikkhim).
2. That skull (2) on the list, no. 58. 6. 24. 150, is also that of a horse. Such large size differences between individual specimens are the expected thing in domestic animals.
3. That specimen no. 91. 10. 7. 176 (no. 3 above) is actually a kiang. This is the only one not presented by HODGSON, and therefore the only one whose locality is known rather than presumed. The form of the skull is that of a good kiang, resembling in its measurements the co-types of *polyodon*.
4. That skull (4), no. 48. 6. 11. 18 is also a true kiang, from the same locality as nos. 48. 6. 11. 16-17, wherever that may be.

It may be noted that the skull of the holotype of *nepalensis* has one label on it bearing the number 58.6.24.118; this however has been crossed out and "119" substituted. On looking into the catalogues of the British Museum under the headings of the HODGSON specimens in question, we find the following: 58.6.24.118. *Poephagus grunniens*: crossed out, nothing else written in its place. 58.6.24.119. *Asinus* (original entry) *hemionus* (added in a different handwriting) *kiang* (in a third hand).

58.6.24.150. *Asinus* (original entry) *hemionus* (added in a different handwriting) *kiang* (in a third hand). All these three numbers fall in a long series presented by HODGSON, with the locality given in all cases as "Nepal".

48.6.11.16 – 48.6.11.18. "Nepal" crossed out; "Sikkhim" substituted.

79.11.21.182. "Nepal".

In another catalogue, the *Asinus hemionus* and *kiang* specimens are catalogued under their 976 numbers, as follows:

976a – 976c (= 48.6.11.16 – 48.6.11.18). *Nepal*, pres. by B. H. HODGSON Esq.

(976d – 976f: other skulls irrelevant to the present discussion).

976g – 976h (= 58.6.24.150 and 58.6.24.119). *Nepal*, B. H. HODGSON Esq. *Tanghan* (Tangtun?).

The word which seems to be "*Tangtun*" written after 976g and 976h in a different hand, may be a place name; but neither of the authors have found any such place on any map. Hence, it has occurred to the authors that the word is possibly "*Tanghan*". One of the authors (V. M.) took care to transcribe the word very exactly from the catalogue, and is sure, studying the formations of the individual letters in the handwriting, that it can be interpreted as "*Tangtun*" as easily as "*Tanghan*", the latter being a vernacular name used for the Tibetan pony (!) (cf. HODGSON 1847; see below).

With reference to localities one may ask, how trustworthy are the labellings of "Nepal". It will be remembered that later curators had changed this into "*Sikkhim*" in most cases, and further changed it to "*Hundes*" in two cases (48.6.11.16 and 48.6.11.17). Brian Houghton HODGSON (1800–1894) was the East India Company's resident in Katmandu, Nepal, from 1833 until 1843, when he was recalled, and in the next year moved to Darjeeling, in India on the borders of Sikkhim. During these years and afterwards he sent large consignments of specimens to the British Museum, collected from the bases of Katmandu (specimens registered up to 1847) and Darjeeling (after 1847). Apparently the British Museum zoologists were unaware for some time of the change of address of their contributor, and continued automatically to label his specimens "Nepal". When they discovered the change, many were therefore relabelled "*Sikkhim*". It is certain, however, that at least some of his collections were obtained from Tibet. Since all the Equidae presented by him to the Museum bear a date later than 1847, the only thing that is certain about their origin is that they were not from Nepal.

There is however certain positive evidence concerning the localities of B. M. nos. 48.6.11.16–18. This is HODGSON's paper (1847) containing the description of *Asinus polyodon*, and dated Darjeeling, 1846. In this he mentions that skins of his new wild ass were "procured through the kind arrangements of Dr. CAMPBELL in my favour", i. e. he himself had procured no specimens. He mentions three skulls, one in the paper and two more in the postscript. On his inaccurate and highly imaginative plate VI, showing two vaguely ass-like animals galloping at high speed through a barren mountain landscape, is written "*Asinus polyodon mihi, the kiang of East Tibet*", but no locality is given in his paper. No mention is made of kiangs inhabiting Nepal; no cause is given for the substitution of *Hundes*, which is an early name for Gnari Khorsum in western Tibet, on the Ladakh. It seems most likely that the skulls came from the area of Tibet to the north of the Sikkhim border; the same area where DENMAN (1950) saw them on his way to Everest and where SCHÄFER collected two specimens which are now in Berlin: this is certainly classifiable as "East Tibet". In the same paper HODGSON speaks of the *Tibetan pony* or *Tanghan* and the Ablac breed of ponies peculiar to Bhutan, feeling it necessary to refute the theory that they are descended from the kiang. It is entirely possible that he might in a later consignment have sent two Tanghan skulls to the museum, along with a juvenile kiang skin, and that they were by mistake all registered as kiangs.

It is finally necessary to mention that in SCHÄFER (1937) also appears the statement that the erroneous theory of hybridisation between kiangs and Tibetan ponies is based on the existence of true horse of „kiangähnlicher Färbung“.

The present authors feel, therefore, that the evidence is overwhelming that the form *Hemionus kiang nepalensis* Trumler, 1959, is based on a mistake, dating from 1858, whereby an adult horse skull and a juvenile kiang skin were referred to the same registration number. It is here proposed to restrict the type specimen to the skin, in order that a form proposed as a subspecies of kiang shall continue to be referable to a kiang, rather than to a breed of domestic horse. If, as seems most probable, the young kiang skin was collected in the region of East Tibet just north of Sikkhim, then the name *nepalensis* becomes a synonym of *polyodon*.

There is no evidence that the kiang inhabits Nepal.

## 5.2. Subspecies of the Kiang

It will be seen from Table 2 that there are three recognisable subspecies of kiang: the small southern race *polyodon*, the large western race *kiang*, and the even larger eastern race *holdereri* with its large teeth and long nasal bones. *Asinus kiang holdereri* represents in fact the largest form of all the Asiatic as well as African wild asses.

In colour there is a good average difference: the eastern kiangs, as pointed out by TRUMLER (1959) are lighter in colour at all seasons with a greater extent of the white underside area; the western kiangs are often very dark in winter, a dark auburn colour, and shining brick-red in summer. The southern race is very similar in colour to the eastern one.

In addition to the three clear-cut subspecies there is a female skull from Lhasa in the British Museum which, though most like *holdereri*, does not fit satisfactorily into that race because of its very long basal length, proportionally to greatest length: a feature observable in *polyodon* as well. It may therefore be suggested that the specimen is a member of a basically *holdereri* population affected by some intergradation with *polyodon*.

In the western and southern races the localities involved are too restricted in area to show population differences. However the eastern series includes two specimens from Seshu Gomba, a locality considerably south of the Kuku Nor area, where all other skulls were collected. These two show a slight difference in the shorter nasal bones; in general, however, they fit satisfactorily into the eastern subspecies, and may be referred to a separate deme of the race *holdereri*.

Two other specimens must be mentioned. These are mounted skins in the Paris Museum; according to the catalogue they came from Lob Nor, i. e. probably from the eastern Altyn Tagh, south of Lob Nor, where kiangs are known to exist (PRZEWAŁSKY, 1878, ed. 1947, pp. 61–62). They agree well in colour pattern with eastern kiangs; but the colour itself may be considerably faded through exposure to light.

## 5.3. List of subspecies of *Asinus kiang* (Moorcroft, 1841)

The three subspecies may be characterised as follows:

### 1. *Asinus kiang kiang* Moorcroft, 1841. Western kiang

1841: *Equus kiang* Moorcroft, Travels in the Himalayan Provinces, 1, p. 312. Eastern parts of Ladakh, Kashmir.

1842: *Asinus equioides* Hodgson, J. Asiat. Soc. Bengal, 11, 1 p. 287. „Plains of Tibet“.  
*nom. nud.* This name may be conveniently fixed as a synonym of this race,

1869: *Asinus kyang* Kinloch, Large Game shooting in Tibet, 1, p. 13,

*Distribution*: Ladakh and neighbouring parts of Tibet.

*Localities*: Ladakh (includes Little Tibet, Rupshu, Hanle and Chibra), Apo Zo on Sumziling Plain, Gunlay (not traced), Spanglung (not traced), Gnari Khorsum.

*Description*: A large race, with comparatively short nasalia, short toothrow, short diastema; colour very dark, especially in winter, with dark areas predominating on flanks.

### 2. *Asinus kyang holdereri* (Matschie, 1911). Eastern kyang

1911: *Equus (Asinus) kyang holdereri* Matschie, in FUTTERER: Durch Asien, 3, 5, Zool. Nachtrag, 29. Southwestern shore of Kuku Nor.

1924: *Microhippus tafeli* Matschie, S. B. Ges. naturf. Fr., Berlin, 1922, p. 68. North-east of Tosson Nor, Wahou Mts.

*Distribution*: eastern Tibet and extreme western Szechuan.

*Localities*: Kuku Nor district (include Bukhain Gol, Great Khatyn Gol, and Tsaidam), Altyn Tagh, Tosson Nor and Wahou Mts., Seshu Gomba, Lhasa (intergrade with next).

*Description*: Somewhat larger than nominate race, with long nasalia, toothrow and diastema; colour lighter, less red, with light area of underside reaching nearly halfway up the flanks.

### 3. *Asinus kyang polyodon* Hodgson, 1847. HODGSON'S or Southern kyang

1847: *Asinus polyodon* Hodgson, Calcutta J. N. H., 7, p. 469. „Tibet“: here restricted to the region just north of Sikkhim border.

1959: *Hemionus kyang nepalensis* Trumler, Säugetierkundl. Mitt., 7, 1, p. 23. (As here restricted). „Nepal“; more probably the region of Tibet just north of the Sikkhim border.

*Distribution*: known only from the area just north of Sikkhim, but apparently occasionally wandering into Sikkhim through the passes.

*Localities*: Lake Gyamtsona (SCHÄFER coll., Berlin), Tibet north of Sikkhim (all the Hodgson specimens), Sikkhim (Mandelli coll., British Museum of Nat. Hist.).

*Description*: Very small in size, with long basal length compared to greatest length. Externally very like *holdereri*.

### Summary

An examination of all available adult specimens with good locality, as well as the relevant literature, has convinced the authors that the Asiatic asses are closely related to the African wild asses, and may conveniently be placed with them in the genus *Asinus*; that the Asiatic forms are divisible into two good species, *Asinus hemionus* and *Asinus kyang*; that *Asinus hemionus* has six subspecies, of which one has not been previously named, and is here described for the first time as *Asinus hemionus kulan* subsp. nov.; that *Asinus kyang* has three subspecies; and that the so-called *Hemionus kyang nepalensis* Trumler, 1959, was based most probably partly on kiangs and partly on Tibetan ponies. The status and interrelationships of the recognised forms are discussed, and the subspecies are characterised with details of size, colouration, skull form and distribution.

### Résumé

L'examen de tous les spécimens adultes actuellement disponibles, ainsi que les données bibliographiques, ont convaincu les auteurs que les Anes sauvages d'Asie sont très proches des Anes d'Afrique et peuvent être placés dans le même genre, *Asinus*. Les formes d'Asie sont représentées par deux espèces: *Asinus hemionus* et *Asinus kyang*. La première comprend 6 sous-espèces,



dont l'une n'avait pas encore été décrite (*Asinus hemionus kulan* subsp. nov.). *Asinus kiang* possède 3 sous-espèces seulement. L'étude du matériel original montre que la soit-disant *Hemionus kiang nepalensis* Trumler, 1959 avait été très vraisemblablement décrite d'après une peau de Kiang et des crânes de poneys tibétains. Les formes reconnues sont caractérisées par leur répartition et par des détails morphologiques (taille, coloration et forme du crâne). Leurs statuts et leurs rapports systématiques sont discutés.

### Zusammenfassung

Eine Untersuchung aller verfügbaren adulten Exemplare mit sicherem Fundort sowie der Literatur überzeugte die Autoren davon, daß die afrikanischen Wildesel den asiatischen nahe verwandt sind und zum gleichen Genus *Asinus* gehören; daß die asiatischen Formen in 2 gute Arten zerfallen: *A. hemionus* und *A. kiang*; daß *A. hemionus* 6 Subspecies hat, von denen eine bisher nicht benannt wurde und hier erstmalig als *Asinus hemionus kulan* n. ssp. beschrieben wird; daß *Asinus kiang* 3 ssp. hat, und daß der sogen. *Hemionus kiang nepalensis* Trumler, 1959 sehr wahrscheinlich teils auf Kiangs, teils auf Tibetische Ponys bezogen wurde. Der Status und die Verwandtschaft der anerkannten Formen wird diskutiert, und die Subspecies werden charakterisiert durch Einzelheiten in bezug auf Größe, Färbung, Schädelform und Verbreitung.

### A note of method of measurement

Skulls were measured in the following way:

Greatest length: Prosthion to inion.

Basal length: Prosthion to basion.

Palatal length: Prosthion to hind border of palate, in midline.

Diastema length: hind border of I<sup>3</sup> alveolus to front border of P<sup>2</sup> alveolus.

Toothrow length: front border of P<sup>2</sup> alveolus to hind border of M<sup>3</sup> alveolus.

Diastema breadth: Breadth of palatal surface in diastema region.

Incisor breadth: Breadth of premaxillae across incisor alveoli.

Palatal breadth: Breadth of palate between inner borders of P<sup>3</sup> alveoli.

Orbital breadth: Breadth of skull across posterior margins of orbits.

Occipital breadth: Breadth of occipital crest.

Opisthion to inion: Distance from opisthion (hind margin of foramen magnum) to inion.

Nasal length: Length of the internasal suture.

The long bones were measured along their greatest length in one plane; but in the case of the radius the ulnar portion of that bone was ignored. Metapodial breadth is proximal.

All the skull measurements are now deposited in the General Library of the British Museum (Natural History), London, S. W. 7, England, where they may be examined on request.

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*Author's addresses:* Dr. COLIN P. GROVES, University of California, Department of Anthropology, Berkeley, Calif. 94720, USA. and Dr. VRATISLAV MAZÁK, Institute of Systematic Zoology, Charles University, Vinická 7, Prague 2, ČSSR

## Zum Vorkommen von Hauseseln zur Römerzeit nördlich der Alpen

Von J. LÜTTSCHWAGER

*Eingang des Ms. 1. 4. 1967*

Auf Heidelberger Boden finden seit Jahren umfangreiche Ausgrabungen statt, durch welche Grabstätten und Siedlungen aus der römischen Limeszeit bloßgelegt werden. Sie werden vom Landesdenkmalpfleger Dr. HEUKEMES durchgeführt. Einst lagen hier römische Kastelle und auch germanische Siedlungen von Neckar-Sueben. An der großen Straße, die aus der Rheinebene auf Heidelberg zuführte, sind damals viele hundert Grabstätten angelegt worden, in denen Aschenreste der Verstorbenen liegen. In dieser Zeit war die Verbrennung der Toten üblich. Bei den Ausgrabungen dieser Stätten kommen zahlreiche Skelette und Einzelknochen zutage. Diese Einzelteile sind Überreste von Mahlzeiten, die Skelette von Hunden und Pferden sind als geopferte Begleitiere anzusehen. Zu Ehren der Verstorbenen fanden Feiern statt, die Überreste der hierbei verzehrten Tiere wurden mit der Asche der verbrannten Menschen der Erde übergeben.